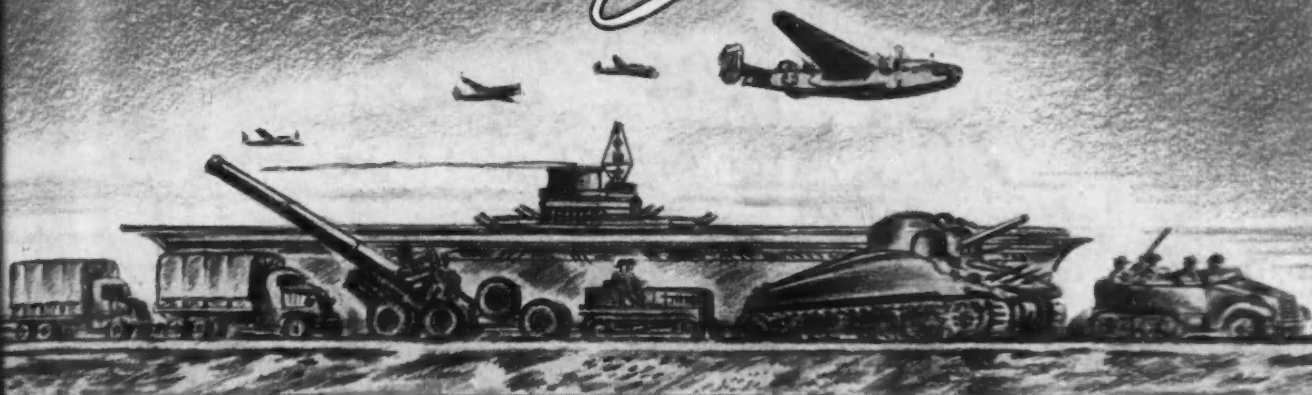
S·A·E Journal



JULY 1944

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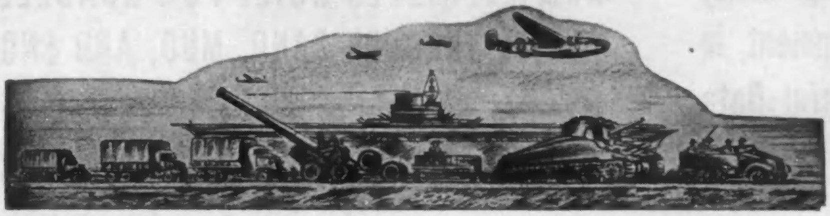


News of the **AUGUST** *Issue*

By Norman G. Shidle

On Childishness

FREQUENTLY heard criticism: "The trouble with that fellow is that he never grew up."

More frequently needed is the criticism that he grew up too completely.

Small children have an insatiable curiosity; they are interested in everything. Big engineers have been known to lose that quality.

Few parents live who sometimes haven't muttered wonderingly: "What ever made the child ask that question?" – and then a few years later been equally puzzled at Johnny's amazing allergy to algebra, literature or history . . . G. K. Chesterton characterized childhood as "a period when one wants to know nearly everything" and contrasted it with the period of what is commonly called education, during which, he says, "I was being instructed by somebody I did not know, about something I did not want to know."

Much of the world's technical progress is made by men who are not ashamed to be childish; who end their days wanting to know nearly everything, simply for the fun of knowing.

When they fail to add maturity in practical affairs, they are generally characterized as "screwballs" but make a contribution to progress nevertheless.

When, matured in judgment and experience, they channel the constant intake of new ideas into practical applications, they become great engineers.

Quality Control Aids Production

PERSISTENT hazard of industrial production is quality failure leading to waste of materials, time, energy, and finances. The larger the plant and the more complicated the operations, the greater the hazard.

In large plants pushed for war production this hazard can be an industrial nightmare, for causes seldom are obvious, usually are difficult to ascertain, and may be the result of practically anything taking place anywhere along the production line.

August *SAE Journal* will present an article by R. H. McCarroll and J. L. McCloud, of Ford Motor Co., which will reveal methods of combating this trouble and of establishing quality control.

They will propound the theory that the best way to prevent trouble is to avoid it. Quality control can be developed, they will say, through the use and enforcement of materials and process specifications.

Quality begins with the raw materials, they will indicate, and the quest for quality must be pursued through all operations.

Engineering Analysis Hastens Air Progress

UNDERLYING progress in aviation, and contributory to its acceleration, is the work of engineers and scientists in the complex field of analyzing flutter and vibration. Shortages of time, manpower, materials, and of everything else, with the possible exceptions of great performance demands and high costs, have tended to make comprehensive analysis an economic necessity.

The empirical approach, which relied largely upon experience and judgment, has long since become inadequate. Flight testing is helpful, but unsatisfactory for the development needs of high-performance aircraft. Increasing size, cost, and performance of aircraft make imperative the development of analytical methods for accurately predicting flutter speeds.

A host of precision instruments, from a punched card calculating machine to a stroboscope, are employed in the work.

Experience in the application of these devices to the problem will be related in August *SAE Journal* by E. Forest Critchlow, of Civil Aeronautics Administration. He will say the punched card calculating machines are particularly helpful, and economical, in using the iteration process to solve matrix equations. Their possibilities appear to be unlimited. He will add that the same tools used for vibration studies can be used for studying dynamic loads.

Engineers Outsmarted Luftwaffe In Historic Air Battle of Britain

INDICATIONS grow that one answer to the ultimate question: "Who won World War II?" will call for a choice, not between armed forces, but between men and machines.

Indications grow also that engineers are contributing more directly to the successful efforts of the United Nations than has been recognized, especially in designing, building, and servicing the machines of war.

Case in point is the 1940 "Battle of Britain," in which the Royal Air Force was pitted against Luftwaffe, Spitfire against Messerschmitt. There are good grounds for belief that the fate of that crucial battle was decided by the technical superiority of the RAF's engines. There are equally good grounds for belief that subsequent victories of RAF over Luftwaffe can be ascribed to British skill in making good aircraft engines better by design improvements as against futile German attempts to win by belatedly making model changes in engines and planes.

The whole story, in technical terms of Merlin engines and two-stage superchargers, will be told in August *SAE Journal* by J. E. Ellor, chief research and development engineer, Aeronautic Division, Rolls-Royce, Ltd., Derby, England.

Interspersed with such engineering data as how the Merlin two-speed, two-stage supercharger is cooled will be explanations of the 40% increase in the power of the Merlin which offset the low-flying tactics of German aircraft. This move forced the Luftwaffe to higher altitudes, and eventually to defeat.

On the basis of British experience with the Merlin aircraft engine, Mr. Ellor will advance the theory that the more promising chance of working the desired miracle of producing greater power without greater weight lies in raising the mean effective pressure on existing engines.

Engineers Probing Enemy Automotive Equipment in Search for Helpful Data

LITTLE-KNOWN engineering service in mechanized warfare is the analysis of captured equipment. It is not a matter merely of idle curiosity, but a scientific endeavor which serves many purposes.

American military leaders have said they will have reliable advance information that victory is in the bag when, as, and if analysis of captured Axis equipment begins to disclose a lack of high-strength, a preponderance of low-strength steels.

Analysis of equipment indicates the probable current status of the enemy's supply of essential materials, and serves also to reveal the probable combat effectiveness of enemy equipment under various conditions. Such information is directly helpful to selection of the conditions under which battles are drawn. Analysis further gives the captor full benefit of the enemy's technological progress, if any.

Currently developing project is the analysis of captured Axis automotive equipment by engineer representatives of SAE War Engineering Board. Comprehensive illustration of the results of analysis of other captured Axis equipment will be published in August *SAE Journal*. An article by John D. Waugh, of Lockheed Overseas Corp. will present particulars of the German VDM electric propeller, on Luftwaffe aircraft.

The information should be particularly interesting to American engineers, if only because direct sources now are closed. American and British bombers have severely handled the Vereinigte Deutsche Metallwerke plants at Frankfurt-am-Main, Duren, and Hamburg.

However, the Axis is the chief loser, it will be suggested by Mr. Waugh, who, after making extended analyses and studies of the Axis product, will voice the conclusion that:

"The VDM propeller is versatile, well-designed, and well-constructed, but not superior to comparable British and American units."

Apply Statistical Theory To Control of Production

A FORMULA which promises a manufacturer that he can, by using it, increase production, decrease scrap, and improve product quality, is likely to be the subject of considerable wishful thinking and of no little appraisal.

One such formula will be presented in August *SAE Journal* by John Gaillard, of American Standards Association, with an outline report of methods of operation and industrial experience in using a "Quality Control Chart."

Mr. Gaillard will describe the formula and the system for its use as being based upon statistical theory and mathematics, as being applicable particularly to highly repetitive operations, and as sufficiently flexible to be adapted to any critical characteristics of manufactured products.

ARMY VEHICLES BUILT FOR ROADLESS TRAVEL THROUGH SAND, MUD, AND SNOW

POST-WAR portent is development by and for the U. S. Army of automotive equipment satisfactory for cross-country travel regardless of terrain, sand, mud, snow, or combinations thereof.

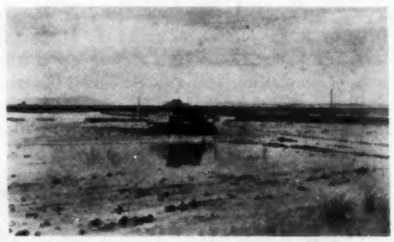
Child of the necessity that motorized armies travel overland, as well as by highway, the development makes new applications of old automotive engineering principles. Result is that a 200-hp, 96,000-lb, earth-moving tractor-trailer, such as ordinarily used on construction work, not only can navigate soft level sand, in which usually it stalls, but can climb 17% sand grades or tow an additional trailed load of 17,000 lb.

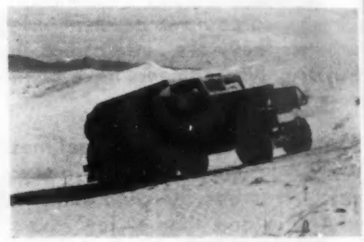
The principles:

- Tires are means of utilizing engine power to produce forward movement of a vehicle.
- Engine power greater than the tires effectively can transmit is wasted unless distributed to more driving axles.
- Essential characteristic of tires is flotation, or ability to stay on, or near, the surface of terrain.
- Necessary to efficient functioning is traction, or the motor vehicle's ability to cling to a surface or substance sufficiently to move itself forward.

There are several other pertinent factors, such as ground clearance, tire inflation, and tread design. However, they appear to be regarded as of less importance than recognition that flotation and traction vary with terrain conditions; that all-wheel drive is imperative.

Out of the Army experiments with cross-country transportation by motor vehicle of loads heavier and more urgent than customarily are those of commerce, have emerged a few simple rules. They will be presented in August *SAE Journal* by Lt.-Col. J. E. Engler, of U. S. Army Ordnance Department, Desert Proving Ground, who will discuss the problems attending the operation both of wheeled and tracked vehicles, and will indicate that the application of principles to wheels and to tracks is not greatly at variance.





Army motor vehicles, whether combat or supply, must be equipped for roadless cross-country travel in sand, snow, mud, and rocky terrain. Traction, flotation, ground clearance are vital factors in cross-country operations. Supply vehicles must be able to follow and to contact combat vehicles, whatever the terrain

Seek Vapor Lock Cure In Study of Gasoline

FORWARD step in solving the complicated problem of vapor lock, which still complicates combat operation of tanks and airplanes, will be reported in August *SAE Journal* as one result of progressive work of the SAE-API Coordinating Fuel Research Committee.

The data will contribute to knowledge of the first in the major trilogy of vapor-lock unknowns – vapor-forming characteristics of gasolines. Still undergoing research are vapor-handling characteristics of fuel systems, and fuel-system conditions which tend to promote vaporization of gasoline.

Data to be presented will comprise results of an investigation of the vapor-forming characteristics of gasolines in the form of a correlation whereby vapor-forming characteristics may be estimated from customary gasoline inspection test data. The results are said to be applicable in considering vapor-lock test data when it is important to know the vapor-forming characteristics of the gasolines employed in the test and, in particular, when it is necessary to apply vapor-lock test results to fuels other than those employed directly in the testing.

The correlation represents work by E. W. Aldrich, of National Bureau of Standards; E. M. Barber, of The Texas Co.; and A. E. Robertson, of Standard Oil Development Co.

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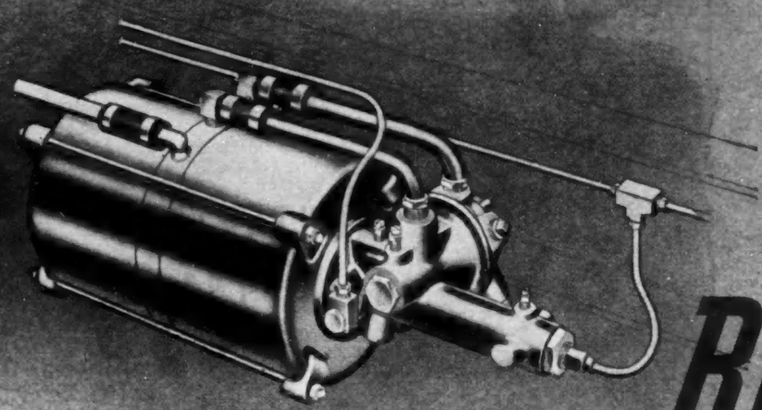
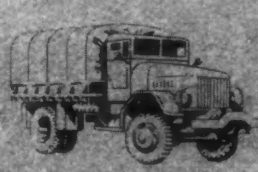




Automotive Materiel in NAVY COMBAT SERVICE

by Rear-Admiral H. G. Taylor (CEC), USN,
Superintending Civil Engineer, Area V, Bureau of Yards and Docks

ALTHOUGH young in age, the SeaBees have already established a history and a tradition. They build air bases from which our planes can attack the enemy. They build naval bases to serve our ships. They build hospitals, supply depots, fuel depots wharves, dry docks, radio stations, powerplants, and all those intricate installations on shore without which the striking forces are impotent.

While no military machine ever had all the equipment it needed, the automotive industry has produced so well that our Construction Battalions are adequately supplied for the pace thus far maintained. However, the pace is certain to quicken as new bases are more vulnerable to Japan's shortened supply lines, and the faster the pace, the greater the demands on automotive equipment. Extended operations mean more bases, more total units, more depreciation of existing equipment, more replacements.

In short, the job of the automotive industry is just well begun.

Encouragement can be taken when the situation today is contrasted with the critical straits in which we found ourselves at the war's start.

When Pearl Harbor was attacked, advanced base construction was being carried on by the Bureau of Yards and Docks and its Civil Engineer Corps officers through private contractors.

These private contractors had pooled their resources and equipment to carry out the contracts, one group in the Pacific, another in the Alaskan sector, and a third major group in the North Atlantic. Their automotive equipment, obtained on priorities, was of their own choice and heterogeneous.

[This paper was presented at the SAE War Materiel Meeting, Detroit, Mich., June 6, 1944.]

The attacks on Wake, Guam, Midway and other Pacific installations, where civilians were engaged under contractors' supervision, brought a complete realization of the difficulties of employing civilians in these forward areas.

At the battle of Midway Island, for example, the contractors' civilian employees were fighting mad, and begged the commanding officer to let them get into the fight. But their plea was refused, since their status as civilians precluded any possibility of their being given any consideration whatsoever by the enemy in the event of their capture. It was apparent, therefore, that if we were to build any advance bases it would be necessary for them to be constructed by men under military discipline and trained to defend what they built. And thus the first Construction Battalion was organized as a part of the Navy.

With the attack on Pearl Harbor the need for great numbers of Construction Battalions became so evident that the forces were rapidly expanded, and today we have a total in excess of 250,000 officers and men engaged in this important and vital work.

When the SeaBees took over the advance base construction, they had no equipment of their own, so it was necessary for them to use the contractors' equipment. Never designed for the high-speed construction demands of war, these commercial trucks deteriorated rapidly and created a tremendous maintenance problem due to lack of standardization.

The first few battalions to go overseas depended entirely on the contractors' commercial automotive equipment taken from the equipment pool in this country. However, by April, 1942, supplies of military equipment began to supplement commercial vehicles. A few four- and six-wheel

drive trucks were obtained from the Army, as well as the ubiquitous jeeps.

Field experience soon demonstrated that the military-type vehicle was far more satisfactory for advance base work than the commercial type. As a result, after December, 1942, no more commercial vehicles were procured.

It is true that commercial vehicles might have been suitable for work at certain well developed bases, such as Pearl Harbor; however, military exigencies might necessitate quick transfers of Construction Battalions to assignments in virgin country of the most difficult type.

But the switchover from commercial to military automotive equipment was gradual, awaiting sufficient production of the latter. In the meantime, up to January, 1943, a total of 3500 commercial trucks was purchased for the Navy's advanced base program.

Production of military vehicles developed fast, though, once it got started. By the end of 1942 the SeaBees had been able to procure 5000. Last year the total jumped to approximately 14,000. This year we expect to obtain more than 25,000, and in 1945 perhaps 40,000.

The military type truck is an amazing vehicle whose performance can be described best by an incident that took place recently when an inspecting officer visited a South Pacific base. He asked a SeaBee what he thought of the truck he was driving. "It's the best damn 5-cu yd dump truck that has ever been built," the SeaBee informed him. The SeaBee's answer illustrates the job demanded of automotive equipment under combat conditions, because it so happened the SeaBee was in the seat of a 2½-ton truck.

To best appreciate the part automotive equipment plays in the construction of an advanced base, it might be well to describe the needs of a single Construction Battalion of approximately 1100 men and officers.

The regular allowance list calls for 12 jeeps, four ¾-ton light pick-up trucks or weapon carriers; four 1½-ton 6 x 6 (that is, six driving wheels) light cargo trucks; four 2½-ton 6 x 6 cargo trucks; and 32 of the familiar 6 x 6 combination cargo and dump trucks, equipped with removable bow tops and seats for personnel.

In addition is the so-called auxiliary automotive equipment which includes: a four-wheel-drive ambulance; a maintenance trailer (which I shall describe later); four ¼-ton trailers, two 1-ton trailers, two grease and lubrication trailers, one 25-ton low-bed machinery trailer, and four 300-gal water trailers.

The foregoing is the allowance list for a SeaBee Battalion as such. However, when the Battalion is sent out with other units for a specialized job, whatever additional equipment the assignment requires is contained in a supplementary list.

In many instances a SeaBee Battalion is attached to a combination of forces serving as a team to construct and operate a new air base, a new fueling and supply base, or a new all-purpose base. These "teams" . . . in the cases of a supply or an all-purpose base . . . call for more than one Naval Construction Battalion.

The additional automotive equipment needed for these specialized assignments consists largely of mobile shops mounted on the chassis of the six-wheel-drive (6 x 6) trucks, such as mobile radio trucks, and repair trucks for landing craft . . . depending on the purpose of the base to be constructed.

On an airfield job, for example, a battalion's standard allowance list might be augmented by 4-ton four- and six-wheel-drive cargo and dump trucks, and by tank trucks of 750-gal capacity for sewage disposal, water hauling, fuel, and for sprinkling the field.

How much and what kind of supplementary equipment is required is left to the discretion of the Area or the Regimental Commander who orders the equipment from Advance Base Depots in the forward zones. Experience has pretty well established what the requirements are, but there is a long hard trip between the factory in the United States and the shore of Island "X."

Factory-to-Battlefront Problems

The journey of equipment from the factory to the battlefronts involves many technical problems. In the first place, automotive equipment for the SeaBees is obtained from three sources: from the Army, the Marines, and our own contracts. It is usually shipped by railroad to our continental advance base depots at Hueneme, Calif.; Davisville, R. I., and Gulfport, Miss. When unloaded, it undergoes thorough inspection and preparation for overseas shipment.

It is picked off freight cars with cranes and hauled by dock mules to the checking area where battery terminals are lubricated and batteries connected, where tires, oil, water and gas are checked. This done, the engine is started for the first time, and the equipment moves under its own power to the inspection center.

At the inspection center, the oil is drained and 9000 Series SAE 30 is used in refilling. Next, the vehicle is completely oiled and greased and running gear and body bolts are tightened. The machines are then run to engine test sheds where they are given a complete check-up by expert mechanics, including a short field test.

The final step is a treatment for rust prevention. The machines are sprayed with antisalt water compound, and all moving parts and exposed parts are covered with rust inhibitor. Every scratch in the protective paint caused by shipping is carefully treated.

The vehicles then are stored awaiting shipment. They are parked in an open field, but usually not for long inasmuch as every effort is made to get them into action as soon as possible.

Pilot models are given rigid field tests, but the proved equipment is considered satisfactory following the tests already mentioned.

The sea voyage is the next step, where the equipment is a prey to salt air and in many cases salt spray when it is lashed to an exposed deck. However, it has the protection of the rust preventative solutions.

The equipment, of course, is drained of inflammables. Gas and oil are not put in at all unless the ships are headed directly for a landing operation, in which case the trucks and other equipment are filled only a few hours before the assault.

In a few cases where an LST's deck is solid with vehicles, machine guns have been mounted on them and they've done all right by themselves. In the South Pacific you would be able to see several tiny Jap flags painted on the bodies of our trucks. Some of the automotive equipment is sent directly to advanced staging bases where it is kept in a pool to be more quickly available for replacements and to meet emergencies.

When the SeaBees arrive at Island "X" their automotive equipment gets its first test during the landing operations.

More often than not, it gets a salt water bath in getting ashore. At Tarawa, for example, some equipment had to be driven through shallow water for several hundred yards. At other landings the bow ramps of the LST's have been let down on solid shore. Usually, however, there is enough water between the ship and shore for the equipment to get a salt water wetting. This wouldn't be so bad if fresh water were available to wash it off immediately, but rarely is any available, even if the men had time to bother with it.

If the landing is opposed, and that must be expected, speed of unloading is of vital importance. If the equipment bogs down, it must be hauled out fast and sometimes none too gently. In one instance a truck which failed to start was blocking the unloading ramp. Enemy planes were overhead. The ship and its unloaded equipment were in dire peril, so a bulldozer simply nosed the stalled truck into the sea. It was unfortunate but necessary.

However, techniques have been devised . . . pontoon causeways, steel matting, and earth causeways bulldozed out to landing ramps . . . thus making the landing of vehicles far less of a problem than it used to be.

Equipment Strained Severely

Once landed and at work on Island "X," automotive equipment undergoes terrific strain in its fight against five principal enemies . . . mud, salt water, salt air, coral dust, and the necessity for speed.

Mud is perhaps the greatest. It is not the mud we know in this country on construction jobs. With as much rainfall in a month as most parts of this country get in a year, the South Pacific islands become quagmires in which vehicles need far more than their four- and six-wheel drives. Until roads can be built they are in constant need of their winches and bulldozers to extricate them. And sometimes even the bulldozers become mired.

Salt water and salt air combine to speed rusting and deterioration of running parts. You can well imagine the results of continually backing a dump truck onto a low coral beach to receive loads of dripping wet, live coral which a shovel or drag line is scooping from shallow sea water.

Particularly vulnerable are the brake drums and axle assemblies. No satisfactory method has yet been found to prevent salt water from getting into the brake drums and rusting them so badly, in many cases, that the wheels lock. Salt water also gets in through the vent in the rear axle assembly and destroys the lubricating value of the grease. Both salt water and salt air speed corrosive processes with the result that the life of engines and all wearing surfaces are considerably shortened.

In addition to these hazards, in the South Pacific coral dust is a major problem. Entering engines through their air intakes and crankcase breather pipe, coral dust is extremely abrasive and results in excessive wear on any engine. Microscopically, it is jagged and fully as abrasive as fine sand. Its power to cut is also demonstrated in its effect on vehicle tires. Our Civil Engineer Corps officers estimate it will wear tires twice as fast as will gravel used for roads in this country.

In addition to these natural hazards, the human factor plays an important part in the lifetime of automotive equipment. Combat conditions result in hard driving of the vehicles. An operator under sniper fire or in imminent danger of bombing attack is not going to have the same careful regard for equipment that he would on a construction job back home.

The exigencies of war often demand extremely high-speed schedules necessitating fast operation of the equipment, fast starting, stopping, and backing. Under such conditions, a driver will hit holes in a road which will break springs; whereas, could he drive more slowly, the vehicle would not suffer. For that matter, even foxholes have been encountered unexpectedly at high speed with obvious results.

To all these difficulties must be added battle damage itself. Automotive equipment is among the first supplies to be unloaded, because it must be unloaded as early as possible to permit the ship which transported it to withdraw from the danger of bombing; and it is needed in the unloading of other supplies.

Shrapnel damage is the worst. You can readily envision what would happen to trucks when even small personnel bombs are capable of slicing off palm trees for scores of yards around. Furthermore, the shrapnel remaining as debris after a bombardment is fatal to tires.

If you were junk dealers instead of automotive engineers, you might be interested in knowing what happens to vehicles which receive direct hits.

Continuous operation of equipment 24 hr a day is not particularly damaging provided facilities are available for proper oiling, greasing, and maintenance. However, I repeat – the critical factors are the speed with which the job must be done, the amount of mud, coral dust, and salt water which must be suffered, and the degree of combat action. These are the factors that determine whether equipment can be made to last three years or only five months.

How long automotive equipment can be kept in useful condition brings us to the subject of spare parts and the methods by which the Bureau of Yards and Docks keeps its SeaBee Battalions supplied. Realizing that spare parts are the life blood of equipment in the combat zone, an elaborate but increasingly satisfactory system was worked out.

Parts Supply

When a piece of automotive equipment leaves the factory, a full year's supply of its estimated needs in functional spare parts is shipped to our central spare parts depot at Joliet, Ill. This is known as the "B" list. Half of these parts are retained there, and the other half are shipped to Advance Spare Parts Depots overseas in the areas where the equipment is sent.

From these overseas depots, battalions are supplied, while at the same time the main depot at Joliet is purchasing an additional six months' supply of parts. The idea is that every piece of automotive equipment should have 18 months' supply of functional spare parts divided between the main depot and the nearest overseas depot.

It has been decided that keeping the spare parts in central depots is more economical than sending them along with the battalions, thus preventing a condition whereby one battalion would find its supply soon used up and another, having more than enough, lying idle.

Of course, some spare parts do go with a battalion. There is an "A" list, which includes a repair kit, attached to the vehicle, containing the so-called "worrying" type of replacements . . . spark plugs, fan belts, bulbs for lights,

fuses, and so forth . . . which can be installed by the vehicle's operator.

An organizational allowance of spare parts is issued to the battalion. These are "parts common" to all vehicles and include brake and clutch lining, ignition wire, spark plugs, condensers, hoses, and many miscellaneous items of a similar nature.

In some instances, when a battalion is going to a part of the world isolated from an Advanced Spare Parts Depot, its spare parts allowance is modified by the addition of a considerable number of parts of the type included in the "B" list.

The preparation of the spare parts for shipping, as in the case of the original vehicles, is done with a view to protecting them from the ravages of weather. So fully protected from sea water are they, that they can be immersed for as much as a week without damaging them. Great care, likewise, is exercised in their packaging to avoid damage and loss.

The problem of supplying spare parts has been largely solved, although our difficulties are by no means entirely over. As the early commercial vehicles are replaced by standardized military types, the situation will improve even more. However, as long as mud, shrapnel, salt water, bombings and interrupted supply lines are part of war, there will be a spare parts problem.

Fortunately, we are not entirely dependent on factory-made parts. Field maintenance by mobile machine shops operated by ingenious SeaBee mechanics has performed wonders in keeping equipment going.

■ Machine Shop Trailers Valuable

The machine shop trailers have been invaluable, equipped as they are with lathes, drills and grinders; tools, cutting and welding outfits, and such other specialized equipment as metalizing outfits which enable the SeaBees to build up worn parts. Each battalion is equipped with one of these trailers and an adequate number of skilled personnel for its round-the-clock operation.

In addition to this mobile equipment many SeaBee Battalions have built machine shops with tools procured from many and odd places. In one instance, a Civil Engineer officer who in civilian life was a machine tool salesman, was serving with the SeaBees in the South Pacific. His battalion needed tools for the repair of its trucks, so he obtained permission to repurchase some that years before he had sold to customers in New Zealand. He found his customers and bought back the tools. Then, with this as a nucleus, a machine shop was started. The man wangled more tools from passing ships. Today the shop is serving all branches of the service and is one of the best equipped in the South Pacific.

In another instance, a little machine shop grew out of a junk pile in the Solomon Islands. The SeaBee proprietors named it ComBotNecSoPac, which is Navy for "Command, Bottle-Neck, South Pacific." But it was no bottleneck, and what it lacked in tools it made up for with ingenuity. When an LST's screws had to be removed and no tools were available, the boys simply blew them off with dynamite. It worked quite satisfactorily, too. They're still doing it.

In addition, the SeaBees have organized special automotive units, or detachments, composed of skilled machinists and automotive workers. These units are sent to key points in the forward areas where they work on equipment repairs which are beyond the capacities of the individual battalions.

Not only have the SeaBees managed to improvise on repairs, but they've done quite a little on-the-spot remodeling. When at one island base they needed another pick-up truck, they cut a jeep in half, lengthened the frame and drive shaft, installed a light truck body on it, and drove it off to work.

Another time, they felt the need of another tank truck, so they took one of their 6x6 cargo-dump trucks, removed the platform and sidewalls, and welded a huge pontoon on the chassis. They finished it off with a home-made sprinkling apparatus and used it to keep down the dust on the roads and airstrip.

Still another outfit needed a platform truck, so once again a 6x6 was called in for the job. They cut off the sidewalls and welded them onto the truck floor to extend horizontally. Of course, its dimensions would never be approved on any highway in the States, but they were a long way from home.

Up in the Aleutians, the need arose for a satisfactory "cherry-picker," so they took an ordinary four-wheeled dump truck and reversed the dump mechanism so that the bed, instead of operating from the rear of the chassis as it did on the dump, would operate from the front of the chassis. Instead of the truck bed, a 16-foot reinforced boom made out of salvaged scrap metal was installed. This strange baby "cherry-picker" can lift a ton and a half high enough to be loaded into a standard four-foot truck bed. The idea worked so well they converted a 6x6 truck into a "cherry-picker" which can lift three tons.

These of course are exceptional cases. In general no modifications of automotive equipment are necessary.

Orders totaling approximately $225,000,000 have been placed for automotive equipment for advanced base work since the start of the war, and of this amount approximately $110,000,000 worth is now in service overseas. The SeaBees keep it going as long as they can, but there finally comes a time when no amount of ingenuity can do much. It is then stripped for every last usable part in the same way that Jap trucks are stripped. The SeaBees don't care where their spare parts come from, as long as they'll work and help get the job done.

As I have said before, the SeaBees' equipment is many times put to uses for which it was not originally intended, and the little incident which I am about to relate well illustrates this point.

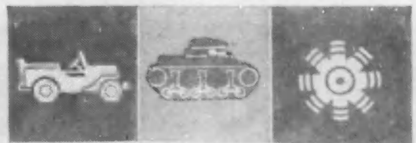
On a certain island in the South Pacific a SeaBee was plowing ahead with his bulldozer. Suddenly he discovered that he was approaching a Jap machine-gun nest. Moreover, he found that he was quite alone. Our SeaBee calmly raised the blade of his bulldozer to protect himself from the bullets and headed straight for the Jap nest. As he approached he dropped the blade and quietly buried the Japs in their own foxhole. Then he went about his work. The papers never reported what he said to the Marines when they caught up with him. Perhaps it's just as well. You know, one of the courses they don't teach at the SeaBees' training camps is restrained English!

In closing, I wish to extend to the Society of Automotive Engineers the appreciation of the Navy Department for the fine cooperation and splendid efforts it has put forth in an endeavor to give us the best possible equipment for use in this struggle for World Peace!

INVASION,

THRILLS National War Materiel Meeting

Inspires Progress Of Vehicle Design For Victory!



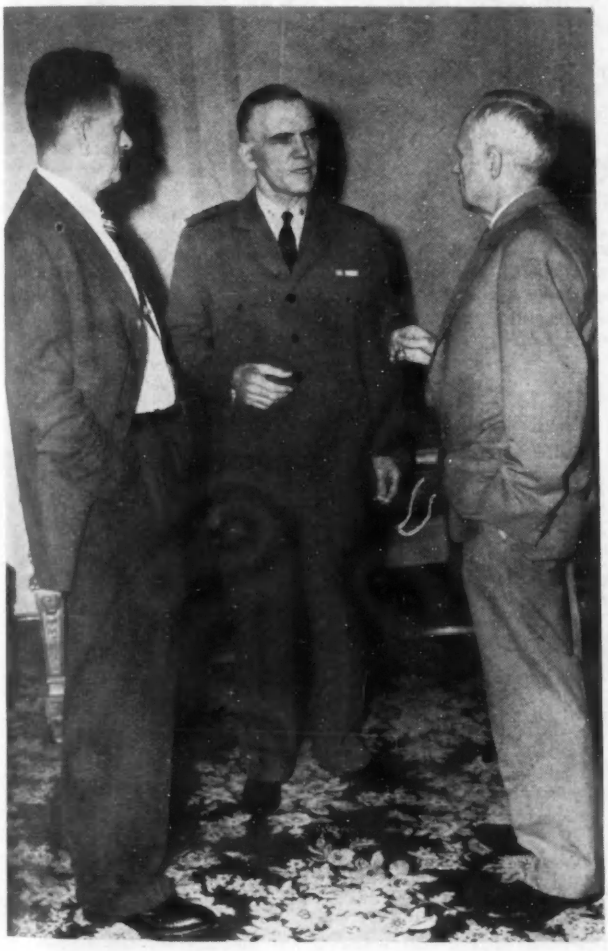
Symbols by Pictograph

THE INVASION began June 6, with thousands of American boys crossing the Channel to great adventure and greater accomplishment.

Automotive engineers, gathered in the Book-Cadillac Hotel at Detroit for the SAE War Materiel Meeting, June 5 to 7, felt in their hearts emotion born of knowledge that war equipment they had wrought was moving forward with fate . . . but kept their minds on the prosaic and essential task of making engineering improvements in new equipment to back the attack.

At the War Materiel Dinner held on the evening of historic June 6, following characterization of the invasion by Toastmaster O. E. Hunt as a "sober moment in the lives of all," members and guests rose for a half-minute of silent prayer for the success of those who are facing death to make freedom endure. Mr. Hunt set the tempo of the meeting when he said:

"We all have high hope that this invasion is the beginning of the end of Axis domination of Europe – but celebrations must come at the end – not now." R. N. DuBois, incoming Detroit Section chairman, introduced Mr. Hunt as Toastmaster prior to the symbolic silence, and SAE



Rear-Admiral H. G. Taylor (C.E.C.) USN, principal speaker at the SAE National War Materiel Meeting, June 5 to 7 in Detroit, with L. Ray Buckendale, left, chairman of the general committee in charge of the meeting and its program, and O. E. Hunt, toastmaster at the dinner

President W. S. James with SAE Vice-Presidents E. M. Schultheis, left, and J. E. Hacker, both members of the General Committee of the SAE National War Materiel Meeting, June 5 to 7, Detroit. Mr. Hacker was also chairman of the Production Meeting.

President W. S. James, speaking briefly, expressed the hope and the prayer "that our engineering services will enable the U. S. Navy to teach the lesson of freedom to all in the world. . . . We like to think," he said, "that a year hence, we may be able to assemble for a *peace* materiel meeting . . . dedicated to constructive progress rather than destructive punishment. . . . In fact, we regard the engineering services we are rendering to our country as our contribution to a better world for all countries."

Rear-Admiral H. G. Taylor, Civil Engineering Corps, U. S. Navy, speaking of "Automotive Materiel in Navy Combat Service," was the principal dinner speaker. His talk is printed in full beginning on p. 17 of this issue.

Sponsored by the Passenger Car, the Truck & Bus, the Passenger-Car Body and the Production Activities and by the Materials Meetings Committee of the SAE, with the cooperation of the Detroit Section, the meeting drew nearly 2000 engineers to the shirt-sleeve discussions of pressing war-equipment problems. Arrangements for the successful meeting were handled by a General Committee headed by L. R. Buckendale as chairman. Serving on Mr. Buckendale's Committee were SAE Vice-Presidents Earl H. Smith, E. C. DeSmet, John E. Hacker, and E. M. Schultheis; Materials Meetings Committee Chairman W. H. Graves; and Detroit Section Past-Chairman A. G. Herreshoff.

The semi-annual business session of the Society was held on Wednesday evening, June 7.

Throughout the meeting, the Invasion exerted something like a cheering-section psychology, inspiring speakers to give all of their new-found engineering knowledge as if every word might help American troops to crack wide open history's most-vaunted defense lines. Fresh engineering horizons were established on the home front as the automotive technicians met with Army and Navy officers for a checkup of recent research work extending from the laboratories of America's greatest engineering organizations to battlefields circling the globe.

War Equipment Progress

The conferences threw new light on design, production, and maintenance of mechanized fighting equipment.

Laboratory tests of Army vehicle dust-proofing devices were described, which reduce to one-twentieth the time of field tests by simulating dust storms. "Storms" of any intensity, using sands from all terrains and under wide ranges of controlled temperatures, have expedited research work being carried on jointly by the Army and the SAE War Engineering Board. Such work as this pierces the horizon of immediate war necessity for better fighting vehicles to vision of better cars and trucks for the post-war era.

The dust test room described resembles a sand blasting cabinet where engines and entire vehicles get simulated sand storms made to order. Sands of numerous types shipped from foreign lands are used in day and night tests.

Results of the test work showed that current dust proof distributors, in which protector caps seal the breaker point compartment, resist dust. Single-plate, dry-type disc clutches appeared impervious although the housing was filled with dust. Even when closed, the inside of the cab was covered with ¼ in. of dust, and some insulation had been removed from the commutator wires of the generator and the starter engaging gear was clogged to a nearly inoperative condition.

Drive shaft splines and universals showed serious wear. Dust deposits were found in the carburetor and intake ports of the block. After 50 hr., measure of centrifuged lubricants showed these percentages of sediment by volume: engine, 1.0; transmission, 2.8; transfer case, 3.8; front and the forward

All papers presented at this SAE National War Materiel Meeting will appear in a later issue of the *SAE Journal* either in full in the Transactions Section or as digests

"An Improved Indicator for Measuring Static and Dynamic Pressures"

F. W. CHAPMAN, General Motors Corp.

"Hydraulic Transmissions for Motor Vehicles"

A. H. DEIMEL, Spicer Mfg. Corp.

"Materials for Preparation and Preservation of Vehicles and Component Parts for Storage and Shipment"

C. O. DURBIN, Chrysler Corp.

Co-author "An Improved Indicator for Measuring Static and Dynamic Pressures"

R. N. FRAWLEY, General Motors Corp.

"Experiments in Dust Room Testing"

R. P. FRENCH, Studebaker Corp.

Co-author "An Improved Indicator for Measuring Static and Dynamic Pressures"

C. E. GRINSTEAD, General Motors Corp.

Co-author "Materials for Preparation and Preservation of Vehicles and Components"

C. E. HEUSSNER, Chrysler Corp.

Henry Ford II, executive vice-president of Ford Motor Co., left, Brig.-Gen. Walter P. Boatwright, chief, Office of the Chief of Ordnance-Detroit, Col. Willard F. Rockwell, chairman of the board, Timken-Detroit Axle Co. and director of production, U. S. Maritime Commission, and K. T. Keller, president of Chrysler Corp.

rear differential, each 2.0; and the rear differential 1.5.

Thus a new step toward qualitative accelerated tests on future vehicle moving parts has been taken, by-product of which will be evolving cab design for the greater comfort of soldiers fighting in dusty terrain and the truck drivers of future commercial vehicles.

Blunt facts were brought back from Pacific outposts about the conditions in which Ordnance and other fighting equipment actually reaches the battle zones. From the factory home front came detailed reports of current technique in preserving materials in shipment—practices which prevent shocking losses of supplies in the hundreds of rough handlings through high humidity, ocean spray, a 170 F range in temperatures, and the uncontrollable destructive exigencies of modern, fast-hitting warfare.

Both Navy and Army spokesmen, as well as civilian engineers who had been sent abroad by their companies or the Armed Services to obtain first-hand data on condition of equipment, reported ravages of terrain and other war conditions which aid the enemy in his campaigns.

Automotive parts eagerly awaited at desperate combat outposts have been utterly ruined by the earlier lack of knowledge of adequate protection and packing of the equipment. Packages are often handled hundreds of times between the factory shipping platform and the first echelon repair station, sometimes crushed in holds of freighters, often soaked for hours in sea water, and always subject to high humidity and frequently salt water spray. Behind-the-lines photographs of piles of useless equipment shocked one of the audiences.

SAE members were praised, however, by another speaker who showed what has since been done to preserve vehicles, aircraft, and parts in reference to standards developed by various SAE committees.

The factual report by Rear-Admiral H. G. Taylor that the automotive industry has given the Navy SeaBees "the best possible equipment for use in this struggle for world peace," was coupled with this prophetic warning: "The pace is certain to be quickened as new bases are more vulnerable to Japan's shortened supply lines, and the faster the pace, the greater will be the demands on automotive equipment. . . . The job of the automotive industry has only started."

Incisive probing into behavior of engines in advance of use can now be made with an improved indicator for measuring static and dynamic pressures, it was reported, opening new channels toward greater specific output and longer operational life.

Development of a pressure sensitive plug coupled with an oscillator-detector unit with its amplifiers, and the recording cathode ray oscillator and galvanometer oscillographs, were described, together with a report on recent engine test work. The main components of the plug itself are a watercooled frame and diaphragm, insulated fixed plate and electrode assembly, coil assembly, and an electrode shield and cable condenser. The plugs have been made in diameters of 14 and 18 mm, and 1 in. and have a range of measurements up to 15,000 psi.

Engineers examined the equipment displayed, and discussed adaptations of its further use in studying design problems of powerplants. The speaker warned that the development work was far from complete, but a number of his audience found in the present equipment a large step forward in engine laboratory technique.

Another checkup revealed how design and manufacturing cooperation — resulting in more diligent attention to tolerances and standardized production processes—has given the Armed Forces a completely interchangeable diesel fuel injector, which readily can be overhauled and returned to use without time-consuming tests.

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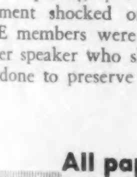
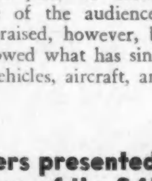
"Some Aircraft Engine Production Methods"



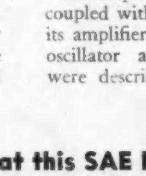
M. M. HOLBEN, Wright Aeronautical Corp.

"Report on Ordnance Materials as Received in Pacific Theatre"



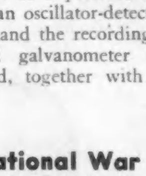
H. T. HOLBROOK, Office of the Chief of Ordnance,

"Improvements in Ferrous Castings Influencing Their Future Use"



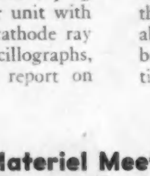
E. C. JETER, Ford Motor Co.

"Wartime Developments in the Heat Treatment of Steel and Their Effect on Automotive Equipment"



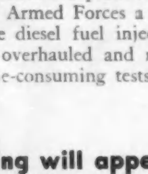
H. W. McQUAID, Republic Steel Corp.

"New Chemical Surface Treaments for Improved Material Performance"



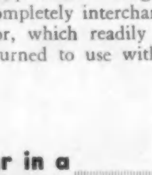
W. M. PHILLIPS, General Motors Corp.

Co-author "An Improved Indicator for Measuring Static and Dynamic Pressures"



H. F. SCHULTZ, General Motors Corp.

"Possibilities of Aircraft-Type Structure in Ground Vehicles"



MAC SHORT, Lockheed Aircraft Corp.

War demands have accelerated this project, it was shown, to make possible injection pressures as high as 40,000 psi—and this new equipment is today in the hands of our soldiers, sailors and marines the world over.

A large part of the success of the manufacturing was laid to hard-boiled quality control at every step in the shop, from careful analyses of the steel and other materials used, to packaging inspection.

Unprecedented metallurgical developments of the past three short years, forced upon the automotive engineers and their metallurgical colleagues by serious critical materials and manufacturing facilities shortages, have blazed new trails in vehicle design of the future. Furthermore, because of the shortage of certain manufacturing facilities, steel casting foundry practice has been advanced well over a decade. One engineer showed specifically how slight changes through design engineer - foundryman cooperation had accomplished the "impossible." Longer radii, smoother approaches, and relocation of webbing all played a part resulting in increasing strength of the part, reduction of weight, and remarkable savings in man-hours.

Likewise, vast advances were reported by another engineer in the field of centrifugal and other types of pressure casting stemming from shortages of manufacturing facilities for the war effort. Because of the rare need for inspection the improved method appears destined to take its place with forgings and static castings of tomorrow.

How the aircraft industry has been moving rapidly toward complete automatic machining was dramatically recounted by an engineer who graphically described the prewar method of manufacturing aircraft engines, how semi-production tools were then used, and the role of the full automatic equipment widely used today to meet production schedules.

Again was emphasized the cooperation of the engineering fraternity – this time the production engineers of automobile engine and aircraft engine plants, and the machine tool designer in accomplishing amazing savings in machinery cost, time of production, and man-hour cost per piece.

Technical unity of the automobile and aircraft industries was another fact specifically illustrated by this meeting. Throughout the sessions sponsored by SAE Activities primarily concerned with automobiles and trucks, the design and production engineering thinking of the older industry was time and again shown to be affected by the developments and experiences of the younger.

Bread Returned Buttered

Frequently it was a case of getting back the buttered bread which had been baked in Detroit and other car and truck centers. A description of current aircraft production efficiency was introduced with this acknowledgment: "The methods which were successfully applied to automotive practices were closely studied and formed the basis for much improvement in aircraft engine manufacture."

Authoritatively predicted was adaptation of aircraft type engines to heavy-duty postwar trucks following an experimental period characterized by a high percentage of failures. Also seen were practical possibilities for aircraft structural elements in the ground vehicles of the future. Even the ultimate in technical unity – a flying automobile – was posited – although predicted upon prior simplification of the airplane down to that of the automobile before the general public can fly safely.

In fact, much of the concern with the post-war vehicles – greater than at any recent gathering – centered around possible utilization of current aeronautical engineering developments.

Prominent truck engineers agree that postwar commercial vehicle engine design can and will benefit materially from aircraft engine developments, but are almost unanimous in the opinion that the benefit will be in the form of 1001 details rather than in radical changes in the basic character of truck power plants.

Backing the viewpoint, fundamental differences in objective and requirements for air and truck engine designs were stressed by several discussers at the meeting. Fact that engine weight is but 1½% of the total truck gross weight, for example, was cited to show that engine weight reduction in the ground vehicles is of minor rather than major importance. Cited, too, was the $1 per hp objective to which the truck designer must work as against the $10 to $20 per hp leeway which the aircraft powerplant designer has at his disposal.

Seek More Economy

Detailing the possibilities of adaptation of aircraft-type engines to heavy-duty vehicles, one speaker pointed to the lightweight, high power, good economy and reliability of current aircraft engines as a means to moving greater payloads over more miles at less cost. High volumetric efficiencies of this type of engine may solve part of the problem of prospective high gasoline taxes, he pointed out. Background of this startling development, as unfolded at the meeting, is the unprecedented engineering effort that has been exerted by the Army, Navy, and aircraft engine engineers to achieve air mastery over the enemy. Thus another new vista for engineers of ground vehicles was opened, albeit with a warning that the adaptation would require extensive and costly experimental work.

Chassis, and bodies, as well as engines, of post-war commercial vehicles are destined to benefit from aircraft structural design experience, according to predictions detailed

Ward M. Canaday, chairman of the board, Willys-Overland Motors, Inc., left, with George T. Christopher, president of Packard Motor Car Co., George W. Mason, president of Nash-Kelvinator Corp., Capt. Norman C. Gilette, USN, and B. D. Kunkle, vice-president, General Motors Corp.

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"The Practical Post-War Car"

BROOKS STEVENS, Industrial Designer

"The Practical Post-War Car"

W. B. STOUT,* Consolidated Vultee Aircraft Corp.

"Problems Involved in Spark-Ignition Fuel-Injection Engines for Ground Vehicles"

N. N. TILLEY, Studebaker Corp.

"The General Motors Diesel Unit Injector"

C. W. TRUXELL, JR., General Motors Corp.

"Improvements in Static Ferrous Castings Influencing Their Future Use"

G. VENNERHOLM, Ford Motor Co.

"Lessons from Aircraft Engines Applied to Heavy-Duty Ground Vehicle Engines"

V. C. YOUNG, Eaton Mfg. Co.

during the meeting. Beginnings were reported of an evolution in commercial ground vehicle design comparable to that which has altered the airplane during the past decade, and which has unified the previously separate operations of designing and building the structure along "civil engineering lines" and then applying fairing to make it aerodynamically sound.

Melding of these jobs has established the principle that aircraft parts must serve multiple functions as stressed units, or risk elimination in the continuing campaign to reduce weight.

"If the modern airplane designer found it necessary to add a fender," it was stated illustratively, "he would make it carry a share of the structural load of the adjoining area in addition to its non-stressed function of keeping the mud off the machine."

SESSION CHAIRMEN

PASSENGER CAR

E. H. SMITH, Packard Motor Car Co.

MATERIALS

FLOYD F. KISHLINE, Nash-Kelvinator Corp.

TRUCK AND BUS

M. M. ROENSCH, Chrysler Corp.

PASSENGER CAR

THOMAS M. BALL, Chrysler Corp.

Designers of ground commercial vehicles are thinking more strongly along these lines, it was indicated, and also are viewing with more than academic curiosity such air vehicle characteristics as stressed skins, shock-absorbing deflections, and weight-saving design. It was evident also that they eye with no little longing the air vehicle engineers' privilege of devoting to static testing and stress analysis hours which match in number the pounds of material in the plane.

Succinct outline of possible trends in ground vehicle benefits from air vehicle design experience was presented in a pioneering and thought-provoking address before one session. Seeking always to match similarities in ground and air vehicle functions, design, and construction, and to create generalized but basic approaches to the problems rather than to work out the details, these conclusions were reported:

- Possibilities of aircraft-type structures are latent in commercial ground vehicles.
- Successful application depends as much upon engineering urge and ingenuity as upon availability of ideal forms and materials.
- Airframe construction is more an art which can inspire truck and bus engineers than a tool to be used in designing.
- To be ahead of the times is to be misunderstood by the times; appreciation of lightweight structures must be developed cautiously in the knowledge that a pound of structural overweight is a pound of payload lost for the life of the vehicle.

Similarity of objectives of commercial ground and air vehicles – to support a sufficient payload at costs which permit of profits, and to travel economically over any given route – were pointed to. The designer of the air vehicle, one speaker said, aims to make the best structural use of available material, so that every part of the structure carries its maximum load, and to make the structure direct and continuous in order to provide a direct and unbroken path for all loads from point of application to point of final reaction. This important step, which eliminates all weak links, enables the vehicle to meet all loads. This characteristic is established by developing a "strength envelope," which comprehends all probable load conditions and combinations.

It was explained that while ground and air vehicles travel different routes, they have many factors in common. Efficient structure for either calls for proper distribution of loads, whether to meet irregularities in roads, or air gusts, whether to meet overloading of ground vehicles or the concentrated loads of high intensity which the air vehicle must meet on landing.

Strong point of difference in design thinking was said to be the tendency of the ground vehicle engineer to place major importance upon fatigue strength of materials, whereas the airframe designer gives first place to structural proportions and relies upon continuity of structure to take care of local stresses.

Still another point of difference was said

turn to p. 30

SESSION CHAIRMEN

DINNER

R. N. DuBOIS, Packard Motor Car Co.

MATERIALS

R. H. McCARROLL, Ford Motor Co.

TRUCK AND BUS

H. A. FLOGAUS, J. G. Brill Co.

PASSENGER CAR BODY

I. L. CARRON, Detroit Harvester Co.

* W. B. Stout's paper, "The Practical Post-War Car," was presented by Walter Turner Fishleigh, consulting engineer.

About

Errol J. Gay (center) civilian technical consultant in the Fuels & Lubricants Division, Office of the Quartermaster General, is shown being awarded a ribbon and citation for his work in connection with two missions overseas which resulted in simplification of the petroleum products supply program and in better coordination of operations between America's and Great Britain's petroleum supply. On his left is Com. Livingston, USN, and right, is Col. George F. Spann, commanding officer, Jersey City Quartermaster Depot

GUY B. ANDERSON, previously chief draftsman in the production engineering department, Librascope, Inc., Burbank, Calif., is now with Adel Precision Products Corp., same city, as liaison engineer.

L. C. WELCH, assistant general manager of sales in charge of the lubricating and sales technical service department of Standard Oil Co. (Ind.) was recently elected a member of the board of directors at the annual meeting of stockholders.

GEORGE M. LANGE, formerly an engineer with Timken Roller Bearing Co., Canton, O., is now connected with Ex-Cell-O Corp., Detroit, where he is working on fuel injection equipment. Mr. Lange is vice-chairman of the SAE Diesel Engine Activity Committee, and is a former secretary and treasurer of the SAE Milwaukee Section.

MERRILL C. HORINE, sales promotion manager, Mack Mfg. Corp., who has been research consultant to the director of the Automotive Division, War Production Board, Washington, since early in 1943, has now returned to New York, but will continue as a consultant to WPB subject to call. Mr. Horine, a former chairman of the SAE Metropolitan Section, is now serving on the SAE Truck & Bus Activity Committee, the Motor Truck Rating Committee, and the SAE Tire Cooperating Committee.

JOHN F. CREAMER, chairman of the board of Wheels, Inc., New York City, and a former vice-chairman of the SAE Metropolitan Section, has been elected a representative of the National Wheel & Rim Association.

ENSIGN EMERY J. SZABO has been transferred from the General Ordnance School, Washington (D. C.) Navy Yard, to Jacksonville, Fla.

WILLIAM LOUIS KAHN, A. S. USNR, may be reached at Midshipmen's School in Chicago. He had been at Pre-Midshipmen's School at Asbury Park, N. J.

FRANK MICKA, JR., formerly project engineer C-87, Pan American Airways, Inc., Miami, Fla., is now connected with China National Aviation Corp., A.P.O. 487, c/o Postmaster, New York City.

Formerly sales manager of Bakelite Corp., New York City, **GORDON BROWN** has recently been elected vice-president of the company. He is a former member of the SAE Passenger-Car Body Activity Committee.

EDWARD R. PROSSER, formerly chief tool engineer for Parker Appliance Co., Cleveland, is now superintendent of machine shops for Warren City Mfg. Co., Warren, Ohio.

M. R. RASPET, a warrant officer, USMCR, has been transferred from the Amphibian Tractor Detachment, Maintenance School, Dunedin, Fla., to Maintenance School Office, Amphibian Tractor Battalion, Boat Basin, Camp Pendleton, Oceanside, Calif.

RUSSELL T. HOWE, who is with the Cincinnati Division of Wright Aeronautical Corp., Lockland, Ohio, has been advanced from plant engineer to assistant plant manager.

Russell T. Howe

Previously chief engineer for Atlas Imperial Diesel Engine Co., Oakland, Calif., **JOHN SEAGREN** is now connected with Northern Pump Co., Minneapolis.

CAPT. HARRY A. BIGLEY, JR., has been transferred from Camp Livingston, La., to Battery A, 553rd Anti-Aircraft Artillery Battalion, Camp Hulen, Tex.

VICTOR H. BERNARDI, electrical engineer for the Maintenance Branch, Office of Chief of Ordnance-Detroit, who received a special commendation from Brig-Gen. Walter P. Boatwright and Col. J. M. Colby last July, recently won the meritorious award for his work in electrical problems.

FRANK M. BEELER, JR., is now in the U. S. Navy at the Great Lakes Training Station in Illinois. He had been control supervisor for Brunswick-Balke-Collender Co., Muskegon, Mich., as a civilian.

ANKER K. ANTONSEN, who had been research engineer for AiResearch Mfg. Co., Los Angeles, is now connected with Baldwin Locomotive Co., Eddystone, Pa.

HARRY HUNTER, formerly chief engineer for Miller, Kuhrts & Rosendahl, Los Angeles, has recently become owner-manager of Hunter Engineering Service, same city.

JOE LYON, JR., is now in the U. S. Army, and may be reached at Camp Abbot, Ore. In civilian life he was chief draftsman for Knuckey Truck Co., San Francisco.

MAJOR A. P. MERCIER has been transferred from A.P.O. 925 to A.P.O. 713, c/o Postmaster, San Francisco.

COL. G. F. JENKS, U. S. Army, Retired, formerly associated with Taylor-Winfield Corp., Warren, Ohio, is now with North American Aviation, Inc., Inglewood, Calif., in the office of quality control.

RICHARD BRADFORD HOOK, formerly laboratory assistant at Wright Aeronautical Corp., Paterson, N. J., is now in the U. S. Navy, stationed at the Naval Training Center at Great Lakes Ill.

G. W. BAIERLEIN is now mechanical engineer for Chandler-Evans Corp., South Meriden, Conn., where he is technical assistant to the vice-president of engineering. Mr. Baierlein was previously connected for a short time with Hub Industries, Inc., Stamford, Conn., as chief designer, and before that was affiliated for 12 years with American Bosch Corp. He was a member of the SAE Diesel Engine Activity Committee during 1941-1942.

ENSIGN ROBERT F. BIRDSALL, USNR, a former student at Yale University, is now an instructor in marine engineering at the U. S. Naval Academy, Annapolis, Md.

N. F. WANGER, who had been an engineering instructor at the Rising Sun School of Aeronautics, Philadelphia, has returned to his former position of engineer at Gulf Oil Corp., same city.

MAJOR EDGAR A. WORK has been transferred from Camp Maxey, Tex., to A.P.O. 9788, c/o Postmaster, San Francisco.

SAE Members

Secretary of War Henry L. Stimson (left) congratulates Lt.-Gen. William S. Knudsen, director of production (center) after presenting him with the Distinguished Service Medal recently. Undersecretary of War Robert P. Patterson looks on (right). Gen. Knudsen is wearing the medal, which is awarded in the name of the President of the United States for exceptionally meritorious service in a duty of great responsibility in connection with military operations against an armed enemy. It ranks second only to the Medal of Honor

AE members who have been named to Automotive Original Equipment Parts ustry Advisory Committee of WPB inde: **P. L. BARTER**, McCord Radiator Mfg. Co.; **C. C. CARLTON**, Motor Wheel rp.; **F. C. CRAWFORD**, Thompson ducts, Inc.; **CHARLES S. DAVIS**, Borgarner Corp.; **DON S. DEVOR**, Houdaillershey Corp.; **M. P. FERGUSON**, Bendix iation Corp.; **DAN H. KELLY**, Electric to-Lite Co.; **JAMES L. MYERS**, Cleved Graphite Bronze Co.; **J. E. PADGETT**, icer Mfg. Corp.; **ARTHUR G. PHELPS**, lco-Remy Div., GMC., **LOTHAIR TEEOR**, Perfect Circle Co.; **HUGH H. C. EED**, Carter Carburetor Corp.; and **C. M. OUNG**, L. A. Young Spring & Wire rp.

Formerly with SKF Industries, Inc., Philadelphia, **HERBERT D. ALLEE** is now affiliated with Moynahan Bronze Co., Detroit.

AE students members newly engaged in engineering work at various production plants throughout the country include:

	Formerly at	Employed by
ERNON J. WATTENBERGER	University of California	General Electric Co.
AWRENCE E. SKEEN	Ohio State University	Bauer Bros. Co.
DWARD W. OTTO	Iowa State College	National Advisory Committee for Aeronautics
HN J. STEWART	General Motors Institute	Fisher Body Division
OY I. ANDERSON	University of Wisconsin	National Advisory Committee for Aeronautics
AROLD BEN FINGER	College of the City of New York	National Advisory Committee for Aeronautics

GLEN W. HAYS, JR., seaman first class in the U. S. Navy, is now stationed at Great Lakes Naval Training Station in Illinois. He was formerly junior tool designer for Frigidaire Division, General Motors Corp., Dayton, Ohio.

ROBERT E. ENGLISH is now a mechanical engineer for the National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory, Cleveland. He was formerly an instructor of experimental engineering at the University of Minnesota, Minneapolis.

T. B. RENDEL, formerly principal technical officer for the British Air Commission, Washington, is now connected with Shell Oil Co., New York City, as special assis-

Bendix - Westinghouse Advancements

E. R. Fitch

AE members who have recently been appointed new positions in Bendix-Westinghouse Automove Air Brake Co., Elyria, Ohio, include E. R. Fitch, from chief engineer to director of engineering; H. W. Jackson, from assistant retail sales manager to service sales manager; A. R. Leukhardt, from manager of manufacturers' sales department to chief engineer; S. Johnson, Jr., from assistant to the assistant general manager to manager of sales engineering; I. F. Nelis, from retail sales manager to manager of Government sales; F. L. Wheaton, from manager of field activity to director of sales; and A. V. Howe, from director of defense activities to sales manager

H. W. Jackson

A. R. Leukhardt

S. Johnson, Jr.

I. F. Nelis

F. L. Wheaton

A. V. Howe

tant to the general manager. Mr. Rendel is a former SAE vice-president, and also served on the Horning Memorial Medal Board of Award.

H. S. MANWARING has been named chief engineer of the Mechanical Research & Development Division of International Harvester Co., Chicago. He had been in the engineering department of the same company. Mr. Manwaring is vice-chairman of the SAE Chicago Section, as well as representative of the SAE Diesel Engine Activity Committee.

THOMAS MIDGLEY, JR., vice-president of Ethyl Corp., New York City, and president of the American Chemical Society, received the honorary degree of Doctor of Science from Ohio State University June 3. Dr. Midgley is the discoverer of the use of tetraethyl lead in gasoline, to which the spectacular developments of high-octane gasoline and the performance of the modern military and transport plane are largely due.

CAPT. A. D. C. STRICK, who had been with the Fourth Armoured Brigade Work Shops, British Middle East Forces, is now with the Seventh Armoured Brigade Work Shops, British Central Mediterranean Forces. Capt. Strick is with the Royal Electrical & Mechanical Engineers.

SAE members who have received recent promotions in the Armed Forces include: **CARL D. BECKER,** who is now a major; **FRANK N. SINGER** and **NILE E. FAUST,** AAF, Section 1, 112th Base Unit, Westover Field, Mass., have been raised to captaincy; **G. K. FEINBERG,** Stockton Ordnance Depot, Stockton, Calif., has been named first lieutenant, and **GUY E. FINOUT, JR.,** A. P. O. 526 c/o Postmaster, New York City, is now sergeant.

In the Navy **WILLARD JEROME DANN,** c/o Fleet Post Office, New York City, and **C. R. JOHNSON,** Aeronautical Engine Laboratory Naval Air Experimental Station, Philadelphia Navy Yard, have the rank of lieutenant commander. **RICHARD F. CORWIN,** Naval Auxiliary Air Station, Philadelphia Navy Yard, is now a lieutenant.

GEORGE W. CODRINGTON, vice-president of General Motors Corp. in charge of the Cleveland Diesel Engine Division, as president of the National Association of Engine & Boat Manufacturers recently observed the fortieth anniversary of this trade organization of the recreational boating industry.

George W. Codrington

Col. Valentine Gephart

VALENTINE GEPHART, USMCR, was recently promoted to the rank of full colonel. Now commanding officer of Air Base Group II at the Marine Corps Naval Air Station, San Diego, Col. Gephart served in the last war in the U. S. Army, first in the Ambulance Unit of the Red Cross, and then in the Signal Corps.

LT. J. S. BRODY has been transferred from the Military Training Section, Army Air Base, Clovis, N. M., to the 231st AAF Base Unit, Army Air Base, Alamogordo, N. M.

VINCENT BENDIX, former SAE president, who resigned two years ago as chief executive of Bendix Aviation Corp., recently announced the formation of Bendix Helicopter, Inc., to produce a new type of helicopter carrying two passengers and baggage at a cruising speed of 100 mph, as well as 10-passenger and 20-passenger models based on the same principles. One of the directors of the board of this company is **CLAIRE L. BARNES,** founder, director and former president of Houdaille-Hershey Corp.

SAE President **WILLIAM S. JAMES,** chief engineer of Studebaker Corp., was one of five persons who received an alumni achievement award at George Washington University commencement exercises May 31.

RAYMOND G. HILLIGOSS is no longer assistant professor of engineering for Oklahoma A. & M. College, Stillwater, Okla. He is now with Boeing Aircraft Co., Wichita, Kan., as lubricating engineer.

R. O. ENSIGN has left Le Roi Co., West Allis, Wis., and is now assistant works engineer for U. S. Rubber Co., Eau Claire, Wis.

MAJOR MURTEN G. HIETT has been transferred from A.P.O. 722, c/o Postmaster, Minneapolis, to Office of the Chief of Ordnance-Detroit.

ROY G. FROGNESS, formerly assistant chief engineer for Western Condenser Co., Watseka, Ill., is now chief checker for Batavia Metal Products, Inc., Batavia, Ill.

HOWARD C. BEYER, formerly senior group leader and standards coordinator of Ranger Aircraft Engines, Farmingdale, L. I., N. Y., and a member of Committee E-5B, SAE Aircraft Engine Subdivision, is now chief engineer of International Diesel Electric Co., Long Island City, N. Y.

CAPT. ROY T. ADOLPHSON, who had been overseas, may now be reached at Battery C, 536th Field Artillery Battalion, Camp Gruber, Okla.

WILLIAM J. CARRY is now a lieutenant commander, USNR, and is stationed at the Bureau of Aeronautics, Navy Department, Washington. Before entering the service, Com. Carry was executive engineer for B. G. Corp., New York City.

Previously district manager for Schramm, Inc., West Chester, Pa., **RICHARD H. WILLIAMS** has joined Philadelphia Metal Works as production engineer.

ROBERT E. EVANS, formerly tool director for Carl L. Norden, Inc., New York City, is now production superintendent for Superior Tool & Engineering Co., Muncie, Ind.

J. P. TRETTON, JR., has resigned from Portland Traction Co., Portland, Ore., as superintendent of equipment, and is now connected with Indianapolis Railways, Inc., in Indiana, as personnel director. Mr. Tretton was chairman-elect of SAE Oregon section for 1944-1945, before business duties forced him to resign this office.

CHARLES I. PRESTON is now aircraft engine designer for Chrysler Corp., Detroit. He was formerly maintenance supervisor, civilian chief trainer, engine ..., U. S. Army Air Forces, Air Service Command, Patterson Field, Fairfield, Ohio.

HOWARD H. LANGDON, formerly head of the mechanical engineering department, State College of Washington, Pullman, Wash., is now head of research and development of Consolidated Machine Tool Corp., Rochester, N. Y.

Previously principal engineering aide, U. S. Navy, Brooklyn Navy Yard, **T. F. KUZYN** is now junior product engineer for Sperry Gyroscope Co., Great Neck, L. I., N. Y.

KARL BROCKEN has joined the firm of G. McStay Jackson, Inc., Chicago, as vice-president in charge of industrial design. For the past six years Mr. Brocken had been associate designer with Brooks Stevens Industrial Design, Milwaukee.

Karl Brocken

TOM L. YATES, formerly sales engineer for Lord Mfg. Co., Erie, Pa., is now connected with Skinner Engine Co., same city.

JOHN E. TERESCHUK is now automotive designer for Chrysler Corp., Highland Park, Mich. He was formerly associated with White Motor Co., Cleveland, in the same capacity.

STUART H. HAHN, who had been design engineer, aircraft powerplants, Curtiss-Wright Corp., Airplane Division Plant 2, Buffalo, N. Y., has recently joined the Arizona plant of AiResearch Mfg. Co. in Phoenix, where he is resident project engineer.

After several months' absence, **D. F. GEISEY** has returned to his position at Studebaker Sales Corp. of America, New York City, as special representative of the National Accounts Division.

LEWIS R. GWYN, JR., formerly automotive engineer, Railway Express Agency, Inc., has accepted a commission as lieutenant, senior grade, in the USNR. Lt. Gwyn is on active duty at the Bureau of Accounts and Supplies, Washington, D. C.

Lt. Lewis R. Gwyn, Jr.

He has been extremely active in the working committee of the SAE Ordnance Vehicle Maintenance Committee, having chairmanned the committee on Limits and Tolerances for replacement of parts and units.

C. H. DOLAN, II, previously a consultant in Kansas City, Kan., and connected with the Commonwealth Aircraft Corp., New York City, is now president and general manager of Carl Dolan Corp., New York City.

LT.-COM. LELAND S. PRIOR, JR., USNR, has been transferred from the Engine Overhaul Section of the Naval Air Station at Moffett Field, Calif., to the Naval Air Station at Alameda, Calif., where he is engine overhaul officer.

MAX H. SCHACHNER, a major in the Signal Corps, has been moved from the Ground Signal Agency in Detroit to A.P.O. 4220, c/o Postmaster, New York City.

CHARLES L. TANNER, who had been a partner of the Hard Chrome Engineering Co., Los Angeles, is now a partner of the Spar-Tan Engineering Co., same city.

Promoted by Autocar

Clement A. Borton above, and Adolph Gelpke, left

Clement A. Borton, vice-president of Autocar Co., has been placed in charge of a newly created quality control department of that organization. The new department will have charge of all elements that enter into insuring quality in the product from the time the designs and specifications are released by the engineering department to the operation of the vehicle in the customer's hands. Adolph Gelpke, formerly Autocar's chief engineer, has been named production manager

SAE members who have received recent changes in company status are: **EUGENE J. FREEMAN,** Adel Precision Products Corp., Burbank, Calif., from plant layout engineer to senior hydraulic design engineer; **WERNER H. E. ENGEL,** Remington Rand, Inc., Brooklyn, N. Y., from designer in charge of the drafting room to product engineer in the Photo-Record Division; **WILLIAM E. THORNLEY,** previously field engineer for Wright Aeronautical Corp., Paterson, has been transferred to Wright Aero Ltd., Los Angeles, where he is field engineering representative; **C. H. DUQUEMIN,** Le Roi Co., West Allis, Wis., from chief draftsman to field engineer; **RUFUS H. BARRETT,** Standard Oil Co. of Calif., San Francisco, from engineer to aviation specialist; **D. B. WEBSTER,** Continental Aviation & Engineering Corp., from chief production engineer at the Muskegon, Mich., branch, to resident engineer at the Detroit office; **RAYMOND E. DUNN,** resident engineer of Chevrolet Motor Division, General Motors Corp., has been transferred from the Aviation Engine Division in Buffalo to the Chevrolet transmission plant in Toledo, Ohio; **BENJAMIN RUSS ALSOBROOK** has moved from Wright Aeronautical Corp. in Paterson, where he was service engineer, to Wright Aero Ltd., Los Angeles, where he is sales engineer; **JEROME D. ALLYN,** Bendix Aviation Corp., South Bend, Ind., from technical representative of the company for the U. S. Army to service representative for Stromberg carburetors; **J. BARRAJA-FRAUENFELDER,** consulting engineer in charge of Special Research & Development Group for American Locomotive Co., has been transferred from the New York City branch to the main plant at Schenectady, N. Y.; **J. O. CHARSHAFIAN,** Wright Aeronautical Corp., Paterson, from assistant project engineer to project engineer; **GEORGE A. PAGE, JR.,** director of engineering for Curtiss-Wright Corp., has been transferred from the Airplane Division at Lambert Field, Mo., to Airport Plant No. 2 in Buffalo, N. Y.; **JOSEPH NORMAN PAQUIN,** Weatherhead Co., Cleveland, from development engineer to chief development engineer; **F. S. CARPENTER,** U. S. Rubber Co., has been transferred from the Tire Division in New York City, where he was general manager, to the Synthetic Rubber Division in Torrence, Calif.; and **PAUL C. ROCHE,** Lord Mfg. Co., Erie, Pa., from field engineer to chief field engineer.

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Dr. Norton B. Moore, right, chief of aerodynamic research, Airplane Division of Curtiss-Wright Corp., and a member of the SAE Aircraft Activity Committee, has been appointed associate director of research at the company's Research Laboratory in Buffalo

WAR MATERIEL

cont. from p. 25

to be the amount of time expended upon stress analysis, the aircraft engineer devoting approximately 40,000 hr to this work in the case of a 40,000-lb transport plane, with 30,000 additional hours spent for static testing. The great number of hours devoted to such tests was said to indicate the high value assigned to weight-saving.

Application of weight-saving studies to a medium-duty truck were said to indicate that some 12,000 hr might be needed to work out a weight-saving of 15%, or around 800 lb, through revision of structural design and exchange of materials. It was estimated that if only one-half this saving could be effected, the original cost of the truck might be increased $400, but savings in operating costs would average $400 yearly.

The cross-country bus was described as best adapted to air vehicle design techniques. It was said that structural requirements of bus and plane are so much alike that improvements to the bus are possible by utilizing airframe structural refinements, but in rebuttal a bus engineer commented that three months devoted by the aircraft engineer to static testing represents the whole time allotted to the ground vehicle engineer to design a complete bus. He added that it would be difficult to design a bus to use materials to yield strength when operators overload the vehicle by as much as 400%.

Per-Pound Costs

Another engineer developed the thought that per-pound costs are greatly in favor of air vehicles. He drew from the speaker the estimate of the aircraft's cost as approximately $6.50 per lb.

The commercial ground vehicle designer can learn from aircraft men the real value of the fundamental design in curvature of surfaces, engineers agreed, but one questioned whether air vehicle design practice of utilizing stressed skins satisfactorily could be applied to truck operations because of frequent damage. It was pointed out that war experience is revealing that shot holes damaging both frame and skin of combat planes easily are repaired.

An avenue to weight saving was suggested: Photoelastic study of stresses in ground vehicles might produce a 50% saving in weight. However, buses and trucks must be built to withstand abuse and accident and to go back into service with quick repairs, whereas when an aircraft crashes "all that can be done is to pick up the pieces," another engineer remarked.

Advantages of gasoline injection as a means to decrease overall fuel economy, despite the probable disadvantages of less reliability inherent in delicate injection mechanisms, and increased costs as compared with conventional carburetors, was suggested as an approach to more economical equipment operation.

However, fuel-injection spark-ignition engines have but limited possibilities in early post-war trucks, majority opinion seemed to be among engineers who discussed this problem at the meeting. Formal presentation of advantages and disadvantages of this type of powerplant, brought informal com-

Rambling Throug

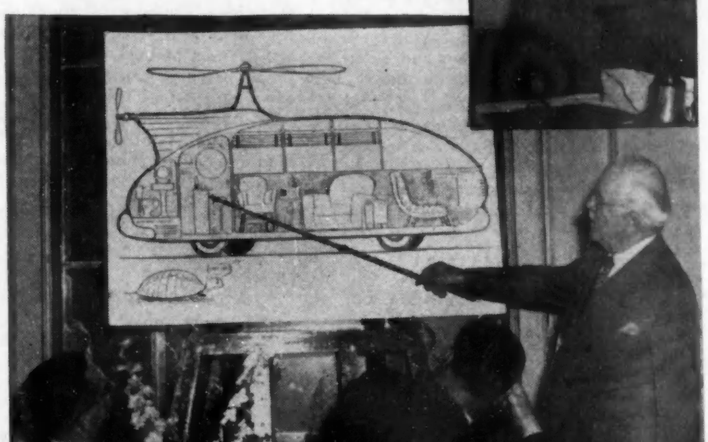
Significant events were crowded into **CANADIAN SECTION'S** annual Oshawa dinner meeting May 19 where over 200 came to enjoy the festivities and hear the Canadian motor industry praised for its war effort . . . the laurels were placed by incoming chairman William A. Wecker, who, after receiving the gavel from his predecessor, Alex Gray, presented the retiring chairman with an engraved "oyster" wristwatch – the Section's parting token . . . Wecker valued the total volume of military transport delivered by Canada's automotive industry to the Armed Forces at $1,133,000,000 since the war began . . . another glowing tribute to automotive engineers for their contribution toward victory was paid by the dean, in membership, tenure, of Canadian members of the Society (1909), Col. R. S. McLaughlin, president of General Motors of Canada – who prefaced his introduction of the evening's guest speaker, Henry G. "Buck" Weaver, with satirical comments on the glamour scribes and artists' visualizations of the post-war car . . .

Historian of General Motors' War Activities, Mr. Weaver talked about Engineers and Human Beings . . . He declared that the genius of engineers and executives in developing mass production and giving the public what it needs has only been equaled by the way in which they have kept secret their accomplishments from the public . . . Frills have concealed the real advances in design that are much more than skin deep, he asserted, and consequently the great contribution to progress that engineering has made is very little appreciated by the public . . . He indicated that one of the important jobs confronting engineers and the industry is to enlighten public opinion as to their functions and achievements . . .

Prizes won in the informal afternoon golf tournament were presented by Past-Chairman R. W. Richards . . .

"Buck" Weaver in action (right) extolling the work of the engineers in this war

Col. R. S. McLaughlin (below) is shown indicating the spirit of the fantasy car of tomorrow, which contains all the comforts of home and a club. Scanning the drawing from the foreground are: A. A. Maynard, chief engineer, General Motors of Canada, and W. E. McGraw, chief engineer, Chrysler of Canada



Section Reports

War films had priority at **DETROIT SECTION'S** May 15 meeting, with movie program consisting of film Communique No. 7, How Good is Your Gun, and Earth Movers, Story of the SeaBees . . .

Hardenability testing, a new technical weapon engineers and metallurgists are using to help win the war, described by A. L. Boegehold, General Motors Research Division, at June 1 meeting of **METROPOLITAN SECTION** . . . motion picture on steel making illustrated the lecture . . .

Patriotism essence of talk by Roger A. Sutherland at **MILWAUKEE SECTION'S** May 5 meeting, in which he extolled America, our method of Government and high level of living as compared with some of dictator countries with which we are at war . . . SAE Past-President A. W. Herrington, main speaker, gave the manufacturer's opinions of the post-war era. (See Technical Ideas for Engineers, May *SAE Journal*) . . .

History of diesel power discussed at May 9 meeting of **NORTHERN CALIFORNIA SECTION** by E. Kuehn, Electro-Motive Corp. . . . only hinted at future development by indicating that a 1400 hp unit, now used for military purposes, is a great advancement, since it is an all-steel fabricated engine weighing 1½ lb. per hp and operating continuously at 140 bmep . . . Trescott S. White substituted for Roy A. Hundley as technical chairman . . .

Inspection trip through the ordnance shops of Vancouver Barracks in Washington made by **OREGON SECTION** May 12, which was followed by social half-hour and dinner at the Officers Club . . . After present-day conditions were discussed by Major C. L. Falls, host of evening, and the importance of the SAE Section was emphasized by W. E. Davenport, past-chairman of Washington Section, a sound movie of the bombing of Tunisia was shown . . .

Future of the diesel in highway transportation was foretold by Paris E. Letsinger, Cummins Engine Co., at **ST. LOUIS SECTION** meeting May 9 . . . expressed hope that various state load limit regulations throughout most of the United States which bar development of heavy diesel transportation on highways will be corrected . . . stated his company is developing their engines in 4, 6, and V-12 cyl types both in regular and supercharged engines using the same size piston – 4⅞ bore by 6 in. stroke – which gives a horsepower range from 100-150, and keeps production cost down with many interchangeable parts for various models . . .

Luncheon meetings have become a regular and well-attended institution of the San Diego Group of the **SOUTHERN CALIFORNIA SECTION** since last November and they are open for both members and non-members . . . Visitors include executives from local companies, officers of the Armed Forces, and members from the Los Angeles area . . .

The Southern Californians celebrated their annual dinner dance June 3 at the Hollywood-Roosevelt Hotel and were entertained by a four-star cast as only Hollywood can produce . . .

How aircraft remote controls operate, their design, size, rate of work output, and possible adaptations to mechanism problems of the present and future were explained at the June 5 **SOUTHERN OHIO SECTION** meeting by Richard M. Mock, Lear Avia, Inc. . . .

Round-table discussion took the place of guest speaker George Martin, Dean Gillespie & Co., scheduled to appear at **COLORADO GROUP** May 23 . . . 25-min films on manufacture of 14-cyl Wright aviation engines, "Cyclone Combustion," and another movie on hydraulic valves added to evening's fare . . .

Stuart Nixon proxied as chairman and master of ceremonies for Paul S. Lane at April 27 session of **MUSKEGON GROUP**, where W. A. Engstrom and Carl Burke, Continental Motors Corp., presented a paper on the development of heavy duty automotive engines . . . dealt with basic engine design such as manifolding, valve timing, cylinder head design, cold starting, pistons, piston rings, lubricating oils and fuels . . . Discussion, which was illustrated by lantern slides, represented eight years of actual service background . . .

Chairman W. E. Swenson of **TWIN CITY GROUP** received a facsimile of the Ordnance Distinguished Service Award from one of SAE's early members, Frank A. Donaldson, at May 4 meeting * . . .

* All other SAE Sections and Groups have already been presented with a replica of the award.

ments which stressed the disadvantages. It was the consensus of opinion that considerable research remains to be done on equitable distribution of fuel to cylinders and proportioning air-fuel mixtures at all speeds.

Self-indictment was fluent as engineers analyzed their sins of omission in respect to transmissions. The infinitely variable transmission of the engine-and-propeller combination led one engineer to say: "We must change the course of our thinking and conceive the engine-and-transmission as a *unit* before we can expect to improve the huge losses we have built into motor vehicles."

In respect to overall design of passenger cars the outlook generally expressed was considerably more conservative than that at most recent meetings of engineers, with the exception of the previously-mentioned flying automobile. An industrial engineer saw the complete elimination of rear fenders, superfluous brightwork, and increased visibility for the driver. Any model bordering on the revolutionary must be a post-post-war model, he said, a point of view heartily agreed to by production engineers who know the cost of drastic retooling programs.

The long-standing discussion about a "small car" and/or a "cheap car" for the American market flared again, resulting in another "no decision" bout, partly, at least, because detailed definition of the terms "small car" and "cheap car" were not made entirely clear. Positioning of the driver at the car front – as in tear-dropped rear-engine designs – was argued again as well, some designers continuing to maintain that greater driver safety accrues from such positioning and others taking an opposite stand.

To SAE Members in The Armed Services

THE SAE is proud of its members in the Armed Services and its civilian members are doing their utmost to back you up here at home.

The Society's Council realizes that some of you do not have opportunities to attend Society meetings or even to devote much time to the *SAE Journal* and, likewise, that it may be a financial pinch to pay SAE dues.

The Council several years ago adopted a policy whereby you may, if you desire, transfer to Reserve Member Status. This means that you would continue on Society rolls with dues waived. You would be welcome at all SAE meetings and receive all benefits of membership txcept the *SAE Journal* and other publications. Another exception is that you would not be eligible to hold National or Section offices. Whenever you wish, it would be our privilege to welcome you back to active membership upon receipt of the then current dues.

All that is necessary to transfer your Reserve Member Status is a letter to the Society's Council advising them that you are in military service and desire to be placed on the Reserve Member rolls.

If you are so fortunate to be situated so that you benefit from your membership and desire to continue receiving the Society's publications, we hope that you will continue your active membership.

With every good wish and the hope that this war will soon be over,

R. M. Critchfield, Chairman
SAE General Membership Committee

Joins SAE Staff

GEORGE H. COMPTER, until recently manager of the Inspection Salvage Department, Brewster Aeronautical Corp., has been appointed as a staff engineer in the Aeronautics Division, SAE Headquarters Staff, by J. D. Redding, Aeronautics Division Manager, it is announced by John A. C. Warner, SAE secretary and general manager.

Mr. Compter started with Brewster in 1938, after graduation from the University of Michigan with a B. S. in Aeronautical Engineering. Beginning as a junior stress engineer, he later became project stress engineer on a single-seat airplane developed by the company and was liaison structural engineer for shop problems before becoming inspection salvage manager.

He has taught aeronautical subjects in the Engineering, Science and Management War Training Program, served as a member of the Survey Committee for Manpower Utilization for the Eastern Aircraft War Production Council and was president of Brewster's Supervisors Club.

Continued expansion of the SAE Aeronautics Division program, Mr. Warner explains, is the reason for this further addition to the Division's personnel.

Section, Group Status to Muskegon and Spokane

STEADILY growing in membership and attendance since its inception in 1942, the SAE Muskegon Group has been granted Section status by the Council, and is now known as the SAE Western Michigan Section. Its territory consists of Ottawa, Kent, Muskegon, Oceana, and Mason Counties – an almost completely automotive area.

The Spokane Group has also been given Council recognition as a separate unit independent of the Northwest Section. Starting with a membership of 12 early in 1943 as a branch of Northwest Section, the group now has a roster of 38. Spokane has rapidly become a center of industrial activity and the Group's territory, which includes Eastern Washington, Northern Idaho, and Western Montana, has a large potential membership.

SAE Subdivision on Shot Peening Meets

At the May 12 meeting of the SAE Subdivision on Shot Peening, the group definitely recommended a series of standard shot size designations with tentative screening tolerances on shot for peening. The subdivision also tentatively recommended a series of standard grit sizes. Work is continuing on shot testing and a study of the possibility of specifications for shot quality and hardness. Members and guests who attended the Detroit meeting were, seated left to right: W. L. and G. H. Kann, Pittsburgh Crushed Steel Co.; Chairman J. O. Almen, General Motors Research Laboratories Division; R. E. Van Deventer, Packard Motor Car Co.; R. L. Mattson, General Motors Research Laboratories Division; I. M. Olsen, Industrial Metals Abrasives, and M. Z. Delp, Studebaker Corp. Second row, left to right: Paul McConnell, Globe Steel Abrasive Co.; H. J. Noble, Jacobs Aircraft Engineering Co.; Norman K. Kann, Pittsburgh Crushed Steel Co.; R. S. Burnett, SAE standards manager; H. H. Zur Burg, Chrysler Corp.; O. C. Sabin, Steelblast Abrasives Co.; C. A. Bultman, Pangborn Corp.; F. O .Grubel, Wright Aeronautical Corp.; R. W. Helmig, W. W. Sly Mfg. Co.; C. A. Reams, Ford Motor Co.; J. M. McKenzie, Cleveland Metal Abrasive Co., and Lt. J. F. Libsch, Springfield Armory. Third row, left to right: L. L. Andrus, American Foundry Equipment Co.; N. S. Mosher, Chevrolet Motor Division; J. F. Ervin, Alloy Metal Abrasive Co.; A. E. Proctor, Ford Motor Co.; J. A. Comstock, Pratt & Whitney Aircraft Division; F. P. Zimmerli, Barnes-Gibson-Raymond Division, Associated Spring Corp.; W. L. R. Steele, Eaton Mfg. Co.; E. J. Burke, Hickman, Williams & Co.; A. V. Mathey, Wright Aeronautical Corp.; J. A. Raleigh, Cleveland Metal Abrasive Co.; E. A. Milke, Harrison Abrasive Corp., and O. J. Gartner, Steelblast Abrasives Co. S. S. Parsons, Parsons Engineering Corp.; H. K. Wallace and M. B. Reed, Industrial Metal Abrasives were absent when the photo was taken

SAE Coming Events

National Meetings

T&M, June 28-29, Bellevue-Stratford Hotel, Philadelphia

WEST COAST T&M, Aug. 24-25, Multnomah Hotel, Portland

TRACTOR, Sept. 13-14, Schroeder Hotel, Milwaukee

AERONAUTIC & ENGINEERING DISPLAY, Oct. 5-7, Biltmore Hotel, Los Angeles

FUELS & LUBRICANTS, Nov. 9-10, Mayo Hotel, Tulsa

AIR CARGO, Dec. 4-6, Knickerbocker Hotel, Chicago

ANNUAL MEETING & ENGINEERING DISPLAY, Jan. 8-12, 1945, Book-Cadillac Hotel, Detroit

AERONAUTIC, April 4-6, 1945, Hotel New Yorker, New York

Metropolitan – July 27

Hotel New Yorker, New York; meeting 8:00 p.m. Exhibit – Captured enemy equipment. Combat films.

Section Vice-Chairmen

EXPANSION of interest and membership of SAE Sections has resulted in approval by the Council of the following Section officers: A vice-chairman representing the Transportation & Maintenance Activity for Kansas City Section; and additional vice-chairmen representing Aircraft, Fuels & Lubricants, Diesel Engine and Transportation & Maintenance Activities for St. Louis Section.

Revising Hardenability Test Method

In view of new developments in steel specifications, the SAE was asked by a joint meeting of the American Iron & Steel Institute's Technical Committee to review present SAE Method of Hardenability Testing (pp. 314 to 324, 1943 SAE Handbook). The new SAE Iron & Steel Subdivision on Hardenability Testing, appointed as a result of this request (*SAE Journal* May p. 33), met May 15 in Detroit for its organization meeting under the chairmanship of A. L. Boegehold, General Motors Research Laboratories Division. Seated, left to right, are: G. C. Riegel, Caterpillar Tractor Co.; N. E. Rothenthaler, Ford Motor Co., representing Fred C. Young; S. C. Knapp, Buick Motor Division General Motors Corp.; M. J. R. Morris, Republic Steel Corp.; Chairman Boegehold and R. C. Sackett, SAE staff representative. Standing, left to right, are: R. R. Kennedy, Army Air Forces Materiel Command; E. T. Walton, Crucible Steel Co. of America; R. B. Hoffman, Chrysler Corp., representing R. B. Hooper; E. A. Reid, Bethlehem Steel Co., representing Henry Wysor; S. C. Boyd, Carnegie-Illinois Steel Corp., representing John Mitchell; H. Hanink, Wright Aeronautical Corp.; W. G. Bischoff, Steel & Tube Division, Timken Roller Bearing Co., and R. S. Burnett, SAE standards manager

Committee Appointments

H. G. SCHWAB, Bunting Brass & Bronze Co., has been appointed a consultant member of the Non-Ferrous Metals Division of the SAE Standards Committee. He succeeds L. M. Long, who recently joined the staff of Battelle Memorial Institute.

C. F. Nixon, Ternstedt Mfg. Division of General Motors Corp., has been named SAE representative on Sectional Committee G8 (ASA) on Specifications for Zinc Coating of Iron and Steel, replacing W. H. Hutchins, Delco Division of GMC.

T. G. McDougall, AC Spark Plug Division, General Motors Corp., has been appointed a member of the Ignition Research Committee.

Dr. M. F. Peters, who has severed his connection with the Bureau of Standards, is no longer a member of this committee.

Council has approved the appointment of George W. Zabel, Fairbanks, Morse & Co., as a member of the Diesel Engine Activity Committee.

Parts Recovery Manual Being Prepared for Army

WORK has been begun by the new SAE Ordnance Vehicle Maintenance Committee on Limits and Tolerances for the Replacement of Parts and Units to compile a manual of successful commercial practice for rebuilding, re-use, or scrapping parts at the time of engine overhaul.

The assignment was made to the SAE OVMC by the Army Ordnance Department, which has named Major George E. Fuller, Office of the Chief of Ordnance-Detroit, as liaison officer.

First phase of the task will be to develop information about rebuilding, re-use, or scrapping engine parts and components.

Basis of the projects will be establishing permissible standards of limits and tolerances of individual parts.

Serving with Chairman Austin M. Wolf on the committee are O. C. Duncan, Sterling Aluminum Products, Inc., St. Louis; Russell J. Cummins, Wesson Co., Indianapolis; G. D. Ford, Railway Express Agency, New York; D. H. Green, National Carbon Co., New York; J. Willard Lord, Atlantic Refining Co., Philadelphia; H. B. Miller, Ohio Oil Co., Toledo; Bryan Park, Central Greyhound Lines, Inc., Cleveland; Roy C. Penrod, Office of the Chief of Ordnance-Detroit; W. G. Piwonka, Cleveland Transit System; Jean Y. Ray, Virginia Electric & Power Co., Richmond; W. A. Taussig, Burlington Transportation Co., Chicago; H. B. Truslow, Richmond Auto Parts Co., and D. K. Wilson, N. Y. Power & Light Co., Albany.

Vibration Damper Patents Available

A LIST of 64 patents relating to vibration dampers and mountings, formerly of enemy ownership, has been issued by the Office of Alien Property Custodian. The Custodian also holds about 30 French patents on this subject.

Engineers interested in obtaining information on these patents may obtain it by writing to Howland H. Sargeant, Chief, Division of Patent Administration, Office of Alien Property Custodian, Washington 25, D. C.

Technical IDEAS

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IMPROVEMENTS IN COOLING SYSTEMS

Promise Better Engine Operating Efficiencies

by C. A. STAMM and W. E. McCRAVEY
Chrysler Corp.

▪ 1944 Annual Meeting

(Excerpts from a paper entitled "Cooling-System Performance of Liquid-Cooled Engines.")

COOLING systems can be classified as to source of pressurization and flow circuit employed. Sources of pressure on the cooling system may be the atmosphere, vapor pressure of the coolant, or an external pump. The flow circuits normally used may be either a series or a shunt hook-up.

Atmospheric Pressurization – The atmospheric system operates with the expansion tank vented to the atmosphere so that atmospheric pressure is maintained in the expansion tank at all times. This system is commonly used for low-altitude operation with a high per cent of glycol coolant.

Self-Pressurization – Pressurizing the system to keep a constant pressure in the expansion tank regardless of outside pressure offers two advantages: It allows a lower per cent of glycol to be used, it also makes the system operation independent of altitude. The lower glycol concentration coolant has better heat transfer characteristics and produces better pump cavitation performance than does a higher concentration coolant. One method of pressurizing a system is by means of the vapor pressure of the coolant. This is known as self-pressurization. The system is sealed with a relief valve in the expansion tank. This valve is set to open at an internal pressure determined by the coolant mixture cooled. The mixture selected has a vapor pressure at its operating temperature lower than the blow-off pressure of the relief valve. The expansion tank pressure then will be that of the coolant vapor pressure. This pressure will be maintained regardless of altitude. A second method of pressurizing would be to apply pressure from an external source, such as the manifold pressure or a separate air pump. Externally pressurized systems, however, are very seldom used, as the additional complication makes them more susceptible to gun fire and mechanical failure.

Series Circuit – The series circuit is used in most British planes and in American planes using British engines. The circuit is shown in Fig. 1, which also shows a representative set of pressures. It will be noted that the absolute pressure at the pump inlet is less than the expansion tank pressure by the amount of the pressure drop through the radiator and its connecting piping.

Shunt Circuit – The shunt circuit is used in most American planes. The arrangement of the units is shown in Fig. 2. It will be noted that the flow differs from that of the series system in that the major portion of the flow from the engine does not flow through the expansion tank but directly to the radiator. A small portion of the flow from the engine, preferably less than 10%, flows through a restrictive orifice into the expansion tank, and from there directly to the pump inlet. The purpose of this is to provide the expansion tank pressure at the pump inlet. Fig. 2 also shows the absolute pressures existing in a representative shunt system. It will be noted that the level of pressures is much higher than for the series system. This is disadvantageous from the standpoint of its being more difficult to retain the fluid in the system at hose connections; however, the many advantages of the shunt system far outweigh the disadvantages.

System Performance

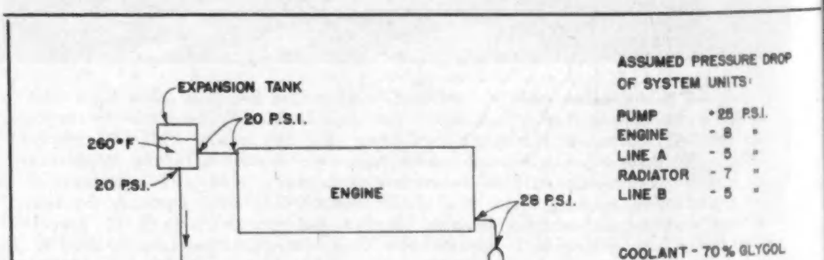
Flow – The coolant flow rate for a given system will be determined by the characteristics of flow versus pressure drop for the system, the pump characteristics, the pump speed, and the degree of cavitation existing at the pump. With no cavitation, flow will be established at the flow corresponding to the intersection of the system characteristic curve and the pump characteristic curve for a given pump speed. The flow versus pressure drop curve for the system is quite dependent on the viscosity of the coolant and, therefore, upon the temperature, since the viscosity of glycol solutions varies greatly with temperature. In actual flight operation, it is very likely that the pump will be operating under partially cavitating conditions a substantial portion of the time. The effect of cavitation upon flow can be shown by a plot of "pressure proximity" against flow.

Pressure Proximity – The effect of cavitation on pump flow rate is very important. The flow is reduced in proportion to the degree of cavitation existing and, in extreme cases, the flow will be zero. The degree of cavitation can be measured in terms of a parameter called "pressure proximity," which is the difference in the absolute static pressure on the fluid at the pump inlet and the vapor pressure of the liquid at the same point. Thus, at zero pressure proximity, the pressure on the pump inlet liquid is equal to the vapor pressure of the liquid, and boiling is taking place, resulting, of course, in zero flow. The term as used, then, can also be interpreted as the proximity of the liquid at the pump inlet to its boiling conditions. Fig. 3 is a representative curve of pressure proximity against flow. Experimental data have shown that the pressure proximity *required* to produce a given flow for a given pump varies with the speed and possibly with the pumping pressures and is independent of the fluid being pumped or the fluid temperature.

Pressure proximity *available* in a shunt system is determined by several factors, the most important of which are: coolant used, coolant temperature rise through the engine, outlet temperature, and engine heat rejection.

Coolant Mixture and Radiator Size

Series System – Radiator size in the series-type cooling circuit is very dependent on the coolant mixture used and on the coolant



▪ Fig. 1 – Series system arrangement and representative absolute pressures existing.

for ENGINEERS

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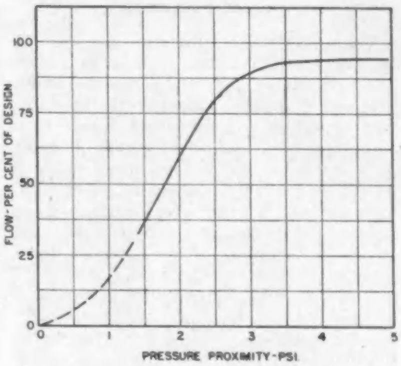
pressure drop through the radiator and through the piping connecting the radiator with the engine. A series-type circuit must use a coolant of low glycol concentration to keep the radiator size within reason.

Shunt System – Radiator size in the shunt system is increased somewhat by increasing the glycol concentration. The more important effect of increased pressure drop through radiator and connecting piping does not affect radiator size in the shunt system, since the expansion tank pressure bypasses the radiator and is applied directly to the pump inlet.

Pipe Size

The present trend in liquid-cooled aircraft-engine installation is to locate the radiator in some part of the airplane away from the engine, thereby allowing a smaller plane frontal area. The two most popular radiator locations are the after part of the fuselage and in the wing near the fuselage, as typified by the American Mustang and the British Spitfire, respectively. For a fuselage radiator, about 30 ft of piping might be required to connect it with the engine. In the case of the wing installation, the radiator would be divided between the two wing halves, and each half might require about 10 ft of pipe to connect with the engine.

As pipe size is decreased, weight of piping and contained liquid of course decrease; however, this weight saving is partly nullified by an increase in radiator size with decrease in pipe size. The coolant flow rate is very sensitive to pipe size, especially in the wing installation, which uses relatively small pipes. The system weight, however, changes but little in the case of the wing installation. For the fuselage installation, the change in system weight with pipe size is more pronounced but is still small. In conclusion, only little weight savings can be expected by reducing pipe size without producing rather drastic changes in flow rate.



■ Fig. 3 – Cavitation performance of centrifugal pump – constant speed.

Radiator Size and Airplane Performance

An aircraft radiator must be of sufficient size to give adequate cooling in a maximum power climb at the best climbing speed; however, this minimum radiator will probably not give the maximum performance to the airplane. The drag of the radiator will be quite high because of the high air velocity through it. Another factor affecting the optimum radiator design is the power gain by jet recovery. This varies somewhat with radiator size. There are two important criteria of airplane performance: rate of climb and high speed. The radiator can be designed to favor either of the two. Fortunately, however, the maximum rate of climb and maximum high speed are obtained with nearly the same radiator size.

Maximum high speed will result from a minimum net cooling power required. The cooling power, neglecting external drag, can be divided into three parts: power to carry radiator weight, power to overcome internal drag, and power recovery by jet propulsion. Power required to carry weight shows up as increased wing induced drag. Radiator internal drag is a function of the radiator air pressure drop and airflow. The jet propulsion effect is due to the addition of heat energy to the cooling air-stream. For the optimum radiator size, the cooling horsepower is almost zero. At altitude, the power recovery by jet propulsion increases still further, so that the power required may be negative, furnishing thrust from the cooling system instead of drag.

Rate of climb is directly proportional to the excess power available and inversely proportional to the weight of the airplane. Excess power available is increased as radiator size is increased because of the reduced cooling drag. The airplane weight, however, increases with radiator size, which lessens the rate of climb. Therefore, it is possible to arrive at an optimum radiator size to give the maximum rate of climb.

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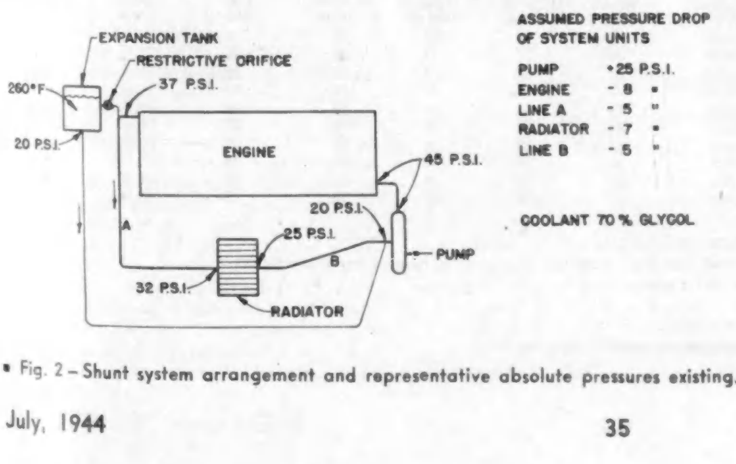

■ Fig. 2 – Shunt system arrangement and representative absolute pressures existing.

Complex Structures Created From Low Carbon Steel With Advanced Welding Technique

by H. E. ROMINE
Carnegie-Illinois Steel Corp.

■ ***1944 Annual Meeting***

(Excerpts from a paper entitled "Mechanical Characteristics of Plain Low Carbon Steel Sheet and Strip")

AN outstanding quality of this class of material is its suitability for fabrication by means of welding. Spot and seam welding are most interesting welding methods because they offer possibility of the rapid assembly of complex structures. Past experience has shown that a composition range of 0.12% max. C, 0.60% max. Mn, 0.040% max. P, and 0.050% max. S provides the most suitable plain carbon steel products for fabrication by these welding methods.

Technical IDEAS for ENGINEERS

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This range substantially includes the present SAE-AISI 1008 and 1010 carbon steels.

In the soft and ductile condition, steels in this composition range have a relatively low strength-weight ratio as compared with some other metals used for light-weight construction. Most articles formed from the soft sheet steel by deep drawing show considerable strengthening of the steel in the drawn areas due to cold working. It is not practicable, however, to make many light-weight structural elements by deep drawing.

Cold Working

Since the most feasible method of strengthening a steel of this composition is by cold working, attention was directed to a study of this method. Reduction in thickness by cold rolling offers a precise means of cold working the steel. Cold rolling also provides a surface generally considered superior from the standpoint of fatigue. The limits of strengthening 1010 type steel were fixed at 25,000-psi yield strength for the softest and most ductile material and at 100,000-psi yield strength for severely cold-worked material having a residual ductility sufficient only for bending around a relatively large radius. The range from dead soft to severely cold-worked steel was then subdivided into five minimum yield strength groups, which were designated as C-25, C-40, C-50, C-80, and C-100. The letter C indicated carbon steel and the numerical values represented minimum yield strength in units of 1000 psi.

Mechanical Properties

A summary of the typical mechanical properties indicated by laboratory testing is given in Table 1. Values are included for the fatigue properties of the virgin base metal as obtained with Krouse fatigue machines. Based on the usual comparison of bending endurance limits in terms of the per cent of the ultimate tensile stress, test types C-25, C-40, and C-50 show good fatigue properties of the virgin base metal. The values are somewhat lower for the higher yield strength C-80 and C-100 types.

Elastic Properties

The good elastic properties characteristic of steel, are evidenced by high initial moduli and relatively high proportional limits. Strength properties transverse to the direction of rolling are somewhat higher than comparative longitudinal properties, probably as a result of the well-known directional effects produced by cold rolling. Compared with the best of some other metals used for light-weight construction, it may be said that in the present state of development, these types of 1010 steel sheets have a good ratio of initial modulus to weight but a poor ratio of yield strength to weight. Thus a weight penalty would be involved in attempting to substitute the 1010 types for some other metals in certain structures where the limiting failure is controlled by yield strength.

High-Speed Fabrication

One of the most valuable characteristics of 1010 steel sheet and strip products is their suitability for high-speed fabrication by single impulse spot or seam welding. Increasing yield strength is accompanied by an increased shear strength of the spot welds and by a decreased pull-out or tension strength. This illustrates the necessity of designing structures to minimize tensile stresses on spot welds in high yield strength 1010 materials in conformity with the general practice of using spot welds in shear wherever possible.

The ratio of pull-out strength to shear strength has been considered a measure of the reliability of spot welds. If a ratio of 0.25 is assumed to be a suitable minimum, the C-25, C-40, and C-50 types exceed this value in all thicknesses, but some of the thicker material in the C-80 and C-100 types are satisfactory in this respect.

Welding Behavior

Sheet and strip rolled from higher carbon steels, such as the 1020 and 1025 are used also for structural purposes, and their advantage is chiefly in connection with welding processes that develop considerable excess heat, such as the gas fusion welding method. In gas welding material that has been strengthened by cold working, the strength in local areas adjoining the weld may return to that of annealed material. This behavior does not apply to single impulse spot and seam welding methods because the quantity of heat generated is so small that the strength of cold-worked steel is not materially reduced except in the highest yield strengths and greatest thickness. The 1020 and 1025 steels are relatively stronger than 1010 steel near a gas weld because of the quench-strengthening effect of the higher carbon content in cooling. The 1020 and 1025 steels, however, generally are unsuitable for spot-welding because the extremely rapid dissipation of heat in cooling may affect these higher carbon steels so as to produce brittleness in the spot welds. Based on increased knowledge of plain carbon 1010 steel products, work is now in progress on some sheets rolled from an X-1015 steel in which the contents of carbon and some of the other usual elements have been increased slightly above the limits of the 1010 steel composition range. Tests indicate that, with some sacrifice in the reliability of spot and seam welds, it should be possible to avoid deterioration in strength near gas welds at least up to yield strength levels of about 40,000 psi. A concluding reference should be made to the new postheat-treatment welding technique, which should enable practically any steel to be spot welded regardless of composition.

Table 1 – Summary of Typical Mechanical Properties of 1010 Steel Cold-Rolled Sheets, Aged [a]

	Tension					Compression[d] (Cylinder Method)				Fatigue[e]		
Type[b]	Ultimate Stress, 1000 psi	Yield Stress (0.2% set), 1000 psi	Proportional Limit, 1000 psi	Initial Modulus, 10^6 psi	Elongation, % in 2 in.[c]	Buckling Stress, 1000 psi	Yield Stress (0.2% set), 1000 psi	Proportional Limit, 1000 psi	Initial Modulus, 10^6 psi	Bending Endurance Limit, 1000 psi	Per Cent of Ultimate Tensile Stress	Rockwell Number (Approximate Range B)
C-25 L	46	40	37	30	24-42	38	36	22	28	28	57.0	40-55
C-25 T	46	42	40	31	24-42	39	37	24	30	29	59.0	
C-40 L	50	44	43	30	20-40	47	45	26	28	32	59.0	50-65
C-40 T	51	47	45	31	20-38	48	46	23	30	33	61.0	
C-50 L	57	53	50	30	12-26	52	50	34	28	33	56.8	60-75
C-50 T	58	56	54	31	12-26	54	53	36	30	34	58.4	
C-80 L	84	82	56	30	3-8	83	76	38	28	42	50.1	85-100
C-80 T	93	91	58	31	3-5	93	88	42	30	44	47.1	
C-100 L	105	103	63	30	0-3	100	89	46	28	46	43.9	90-105
C-100 T	116	112	67	31	0-2	116	110	57	30	49	43.5	

Specific weight: 0.2833 lb per cu in. or 490 lb per cu ft.

Nominal chemical composition: 0.10% C, 0.45% Mn, 0.010% P, 0.030% S, 0.010% Si.

[a] These data are safely based on aged material (aged by heating at 450 F for 5 min or equivalent); material as received may be slightly softer.

[b] L – longitudinal to direction of rolling. T – transverse to direction of rolling.

[c] Elongation values vary with thickness.

[d] Compression data based on determinations made on 0.018 in. thick material.

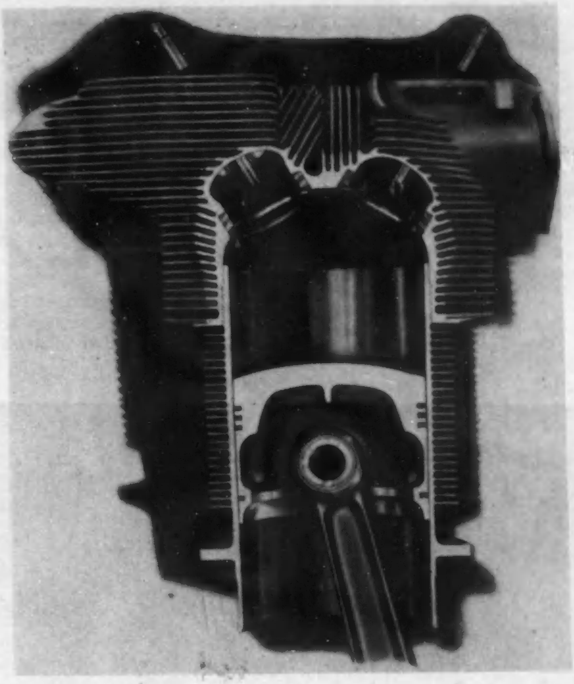
[e] Bending endurance based on 10,000,000 cycles of completely reversed stress – 0.018 in. thick material.

Ring-Piston Factors Guide Design of Aircraft Engine

by C. H. VAN HARTESVELDT and M. EPPS
Ranger Aircraft Engines

▪ 1944 National Aeronautic Meeting

(Excerpts from a paper entitled "Piston-Ring Development for the V-770 Engine")



▪ Fig. 1 – Cross-section of the piston and cylinder for which a proper ring combination was sought.

DURING the development of the Ranger SGV-770C engine, it was necessary to develop a ring-piston combination that would work under the conditions imposed. Because the engine had many features new to American practice at the time, some aspects of the problem were unique. These features are among those listed below:

Engine Type: In line, aircooled, inverted V
Horsepower, Take-off: 520 at 3150 rpm
Normal: 450 at 3000 rpm
Displacement, cu in.: 770
Bore, in.: 4
Stroke, in.: 5⅛
Average Piston speed at Take Off, fpm: 2690
Bmep at Take Off: 170

Almost all features of the power-section design have a bearing on ring function. Among these are cooling, cylinder finish and material, piston design, quantity of oil thrown to the cylinder walls and to the piston, carburetion, manifolding, and in addition, the fuel and oil used. Improper handling of any one of these can make the ring problem inordinately difficult.

Fig. 1 shows a cross-section of the piston and cylinder for which a proper ring combination was sought. The selection and development took the course of a broad exploration of ring type, number, and location.

Even with engine variables held constant, ring development is a complex problem, and no one test can be used for a final answer. This is because the demands upon piston rings vary markedly over the range of engine operation necessary. To say that rings must hold oil consumption and blowby to a minimum without deteriorating too rapidly is a correct statement, but it is also an oversimplification. The tendency to stick in the grooves or wear out during long periods of operation at rated power or high bmep cruise must be measured. No ring combination must flutter at diving speeds resulting in high blowby, oil consumption, and ring breakage. A reasonable resistance to abrasive wear is required and the run in for production purposes can not be unduly long. The result is that an initial piston-ring development starts as a compromise and is continually modified until successful service operation is achieved.

There is often a tendency in testing to start out with an economical, small-scale test for the initial work and then to apply additional tests successively nearer service conditions to fewer and fewer survivors of the weeding out process. In the case of piston rings, such a procedure must presuppose a precise knowledge of the conditions under which rings operate. These conditions are not well known and particularly not for a new engine, so we decided to use full-scale engine tests first and single-cylinder tests later. Even with full-scale experience, our later difficulties in choosing the proper conditions for our single-cylinder test confirmed the soundness of this approach.

The dive testing showed that 1/16-in. wide piston rings were the only type out of ten combinations tried that were successful in sealing against blowby at the piston speeds required. This type of ring also proved to be good endurance-wise and for controlling oil consumption.

Dished ring grooves to compensate for thermal distortion of the piston and torsional rings did not appear to offer sufficient improvement over conventional practice to merit adoption. Narrow wedge rings showed an improvement in ring sticking, but their scuffing and wear tendency prevented their adoption in the face of satisfactory ring-sticking performance of the plain, narrow ring.

Production run in is a piston-ring problem that cannot be fully anticipated because of the limited number of full-scale engines used for development testing. Difficulties with run in, however, can mount to such proportions that a modification of the rings is sometimes required.

The final solution to piston-ring design can come only from service experience with the several installations and methods of airplane operation that ultimately occur.

DISCUSSION

In discussing the authors' paper, C. F. Bachle, Continental Aviation & Engineering Corp., said that surface finish should be emphasized as one of the most important items affecting rings, as it has an extremely significant effect on scuffing and run in. He believes in the two-compression-ring theory, but stated that in addition a steel top ring or possibly a centrifugal cast iron one has to be used.

When a question was raised about cylinder finish, Mr. Van Hartesveldt said that there is very little known about it, but that he has had excellent results with shot blasting and even sand blasting.

PNEUMATIC DE-ICERS TAILOR-MADE TO SATISFY SPECIFIC PLANE NEED

by J. E. GULICK
B. F. Goodrich Co.

▪ 1944 National Aeronautic Meeting

(Excerpts from a paper entitled "The Pneumatic De-Icer")

IN considering the pneumatic de-icer, we are concerned with a pulsating mechanical device applied externally to entering edges of aircraft. The complete system comprises a proper air source, a distributing system for the air, with proper timing for selective alternate inflation and deflation of a sheath of rubber and synthetic by means of rubberized tubes strategically placed and made as an integral part of the entering edge covering.

The device is tailor-made to fit the aircraft for which it is designed. It is operated from the air source in such manner as to produce the forces necessary to keep the entering edges freed from the dangerous ice that could accumulate with results that are known only too well. The de-icer structure is carefully developed, keeping in mind the requirements as to coverage, stretch, surface, attachment, weathering, and main function.

De-Icing Accomplished in Three Ways

It has been generally recognized that there are three possible approaches to the

ice elimination, removal, and prevention problem: chemical, thermal, and mechanical.

Chemical means can consist of low adhesion treatments or freezing point depressants.

Thermal means can make use of either gas heat or electrical energy.

Mechanical systems may include vibration means or other devices for distorting the surface.

If our conclusions are correct, there is not now in view a complete cure-all for the aircraft icing problem.

Four Questions Answered

There are four sections of the problem, about which we must know as much as possible before we can successfully continue to solve the problem, especially as cleaner airfoils, higher speeds, and greater maneuverability, with higher wing loadings, move apace.

1. Under what temperature conditions must the system operate?

Ice will form on aircraft when there is in the atmosphere visible moisture in the form of sleet, snow, or supercooled water droplets, and when the temperature is below 34 F. Also, since aircraft may be subjected to extremely depressed temperatures, the rubber or synthetic so-called boot must be made of materials compounded to be flexible at temperatures lower than −50 F, not that they must be operated at these low temperatures to remove ice that may form there, but in event the airplane quickly strikes icing conditions while coming from colder regions without warm-up time. The operating mechanism and controls also are being improved to meet these conditions.

2. What physical properties has the ice to be encountered?

There is glaze ice, which is formed by freezing rain or drops relatively large at or near freezing. This type is relatively solid, clear, and smooth, and mainly only increases plane weight.

There is rime ice, which is the most common. It is formed from near-average-size droplets of supercooled water and is more or less opaque, but porous, and can be depended upon to form without symmetry. With this rough formation comes loss of lift and instability. It can be expected to increase stall and landing speeds.

Then there is a combination of rime and glaze commonly called glime. This is the intermediate type, and usually forms between 15 and 28 F. It, like rime, is more or less opaque, but forms more uniformly. This type combines the worst features of both rime and glaze.

To answer this question, therefore, we briefly say that the de-icer must be prepared to cope with any one or with all of the three main types of ice that can be encountered, but more particularly the rime variety, as it is the most common. How well the de-icer does its job depends on the character of surface, tube configuration and size, speed of inflation and deflation, and operating technique—the most important of all.

3. At what rate will the ice form?

Ice may form as slowly as 1 to 5 in. per hr or as rapidly as 1 to 4 in. per min. Obviously, operating technique, as well as the other factors called to attention under No. 2, make for the successful operation of the de-icer in both high and low rate areas.

4. What areas will the ice cover?

We find the extent of the coverage of the ice to be subject to many variables. From the data available at this time, we can safely assume that if protection is provided for the 7% area of the entering edges, the aircraft can be flown successfully in all reasonable icing conditions.

Basic studies we have made in flight, in laboratories, and wind tunnels are all turning in information that will be helpful to the general problem.

New De-Icer Developed

It would be akin to sacrilege if I were to avoid mention of the development of a new de-icer operating mechanism. It is an electronically controlled system with solenoid valves for inflation of the de-icer boots. The advantages of this newer system are numerous, the chief ones being selectivity and rapid action with less internal plumbing. The selective feature will permit the pilot or flight engineer to control inflation by location, length of dwell, and frequency.

Likewise, we expect to be able to release for use shortly a treatment for the surface of the rubber de-icers that will ensure a lessened adhesion between the boot and the ice. The treatment is not to be expected to prevent ice forming, but every test indicates a perfectly clean and smooth rubber surface after the ice has been broken away.

High Humidity, Rain Invite Corrosion on Tropical War Fronts

by LT.-COM. R. E. WHITE, USNR

Navy Department, Bureau of Aeronautics

■ National Aeronautic Meeting

(Excerpts from paper entitled "Operational and Maintenance Difficulties")

HIGH moisture content, that is, constant high humidity and tropical showers contributed to many engine and airplane difficulties both in operation and maintenance in the South Pacific.

The moisture had a direct effect on equipment by setting up corrosion, and on ignition systems by condensation of water vapor throughout the entire ignition and electrical systems in the airplanes. Although the ignition systems were partially protected by the introduction of condensation inhibitors within the shielding, barrel, terminal and connecting elbows on the spark plugs, this preventive did not completely eliminate the difficulties experienced. Thus, frequent warmup of the engines, commonly referred to as a drying out process, was found to be a last resort.

It was desirable to eliminate the use of both engine and cockpit covers as they added to the difficulties by housing the moisture. Moisture and rapid changing of temperature within the locality also had some effect on the lubricating oil by causing condensation within the lubricating system. At times a considerable amount of sludge would be found in the engine oil strainers. This affected the engine oil pressure, requiring the oil system to be completely drained, flushed, and refilled.

Corrosion Hindered Maintenance

One of the airplane difficulties that was attributed to moisture was corrosion set-up in the landing gear mechanism, which sometimes was severe enough to cause the gear to be completely inoperative, necessitating a crash landing. This trouble was eliminated by proper maintenance and frequent lubrication of the landing gear actuating mechanisms and a redesign of the landing actuating parts.

Operational difficulties were extremely hard to diagnose, but some which were discovered were caused by a failure of carburetor diaphragms, which was attributed to the use of aromatic fuels in the early stages of operations. Also, some diaphragms deteriorated and became porous due to the engine standing idle either in shipment or in reserve, and no doubt, some of the diaphragm difficulty we attributed to preservatives that were used.

Some ignition difficulty was encountered in high altitudes prior to the incorporation of ignition pressurizing systems.

Coral Used for Sandblasting

Considerable coral and coral dust prevailed in the area and from experience it was determined that coral dust had very little, if any, effect on engine operation or life. We finally adopted the use of fine live coral to be utilized in sandblasting equipment. We found it would not attack the metal and after experimenting with its use, we discarded the liners within the cylinder barrels while doing this coral blasting operation.

Some complete overhaul facilities have been established in the South Pacific and they have proved invaluable, not particularly in the overhaul of engines, but for the fabrication of parts, both standard and the ones necessary to incorporate local changes.

There is a definite need for automatic power control to allow the pilot to concentrate on the tactical situation confronting him. When added power is needed, a compensating factor, such as water injection, is introduced for the elimination of detonation. If this water injection system is automatically controlled during the period of war emergency power, it serves a twofold purpose of automatically controlling the power output and relieving the pilot to devote his attention to the enemy. Automatic power control should also increase the life span of the engine between overhauls.

We have concluded that the following points are evident:

1. In aircraft, controls should be

standardized and instruments should be in the same relative position on the instrument panel; controls for the engine are combined into one major control – the throttle; airplane demands constant maintenance and accessories should be easily accessible and interchangeable between various types of aircraft; and there should be improvement of quick-change set-ups for engine change.

2. Tropical experience demands that military units have mobile equipment and that they can take their A&R shops to the plane. Portable equipment of all kinds is needed in the combat area.

3. It is the problem of the trained engineer to design and build an airplane or engine that will give better performance than its predecessor.

DISCUSSION

(Lt.-Com. F. E. Johnson, who delivered Com. White's paper in the latter's absence, interspersed the presentation with interesting anecdotes drawn from his personal experience in maintaining Navy warplanes in the Solomons.)

Referring to the corrosion problem, Chairman Raymond W. Young, Wright Aeronautical Corp., asked what the best method of corrosion preventive to date is. Com. Johnson replied that the use of silica jel is effective, but added that it is not the perfect solution, because some engines in the South Pacific still have to be represerved.

The greatest problems in such an area as the Solomons, he asserted, are corrosion of cylinder barrels, overhauling engines, overhauling parts, and lack of conditions found in normal climates. He added that even new equipment suffers from corrosion, making it an ever-present problem.

The situation has been somewhat alleviated, he said, by storing equipment in semi-air conditioned storage places, using dry heat, circulating air, and so forth. Another method being used for such parts as spark plugs is sealing them either by a lead seal or in pliofilm. Also, by applying silica jel and having periodic inspection of equipment, corrosion may be forestalled.

Discussing the time element in maintenance, A. T. Colwell, Thompson Aircraft Products, Inc., said that the logical thing would be to replace faulty with new equipment instead of rebuilding it at the front.

Com. Johnson suggested from his personal experience that in getting technical data out to the field, manufacturers should cooperate with the military services and make sure that such material is published in time so that it will reach the field and avoid the considerable lag occurring in the past.

A. L. Beall, Wright Aeronautical Corp., referring to the problem of excessive sludging, attributed it to the use of oils mixed together. Keeping the oil temperature rise low enough to prevent evaporation of the moisture causes condensation and sludge in damp climates, and he asserted that if oil is allowed to get hot enough the sludge trouble will usually be cured. There are two types of sludge, he explained – mixed oil sludge which clogs the strainer once only, and water sludge which is constantly present when conditions favor its formation.

Reverting to the question of corrosion, Mr. Beall said that, under present conditions, parts could not be preserved for a longer period than three months.

Praising the use of the water injection system about which Com. Johnson spoke, Chairman Young related the fact that Germany has realized its benefits and is now using it in their aircraft.

Com. Johnson's reply to the query by Charles W. McAllister, Sinclair Refining Co., as to what the boys in the South Pacific do when they need a certain type of grease was that they usually use what is on hand; this, of course, has caused difficulty. He remarked that the problem of keeping up with specifications does not only apply to grease – but he did say, that as a precautionary measure, when a part requiring special grease is shipped, a small quantity of lubricant required be shipped also.

M. R. Balis, Bendix Aviation Corp., asked about keeping foreign material out of fuel. This is difficult to combat, the speaker said, because there is no way of determining where the source of bad fuel is. Then too, the trouble may be traced to outside factors, such as improper storage and carelessness rather than to a defect in the fuel. He added that lack of properly preserving diaphragms is another maintenance headache. He had no difficulty, however, with oil coolers on the PBY's and PB4Y's, which is the type of aircraft he has worked on.

Progress in Fan Design Broadens Usefulness of Air-Cooled Powerplants

by P. A. SIDELL
De Bothezat Division, American Machine & Metals Corp.

■ Twin City, March 2

(Excerpts from paper entitled "Applications of Aircooling to Post-War Engines and Related Engine Cooling Problems")

A FEW advantages of aircooled engines in certain applications are:

1. Elimination of expensive radiator.
2. Elimination of water pump with attendant packing and bearing troubles.
3. Freedom from corrosion.
4. Freedom from freeze-up in cold weather.
5. Lighter weight and greater compactness.
6. Lower susceptibility to unexpected failures, due to elimination of above listed equipment.
7. Improved performance possible in most cases.
8. Makes packaged power installations more practical, making possible maximum utilization of equipment.

A number of developments which have been made in aircooled engines during the past few years are:

1. Developments in fans resulting in much higher performance, compactness and greater strength.
2. Developments in engineering materials making possible greater strength with less weight and less cost.
3. Improvements in heat conductivity characteristics by such materials as aluminum clad steel.
4. Alloys capable of higher operating temperatures.
5. Developments in lubricants making possible adequate lubrication at higher operating temperature.
6. Improvements in fin, baffle design, air handling ducts, and manufacturing methods.
7. Development of higher octane fuels.

Fan Pressure Depends on Root Section

Pressure characteristics of a fan are to a major degree dependent upon the characteristics of the root section. A root diameter is generally selected having sufficient velocity to develop the required pressure with the required flow. The area in between this diameter and the hub is closed off as its velocity is too low to develop the required pressure, and it would cause excessive turbulence which would run out along the blades, causing premature stalling of the outer areas.

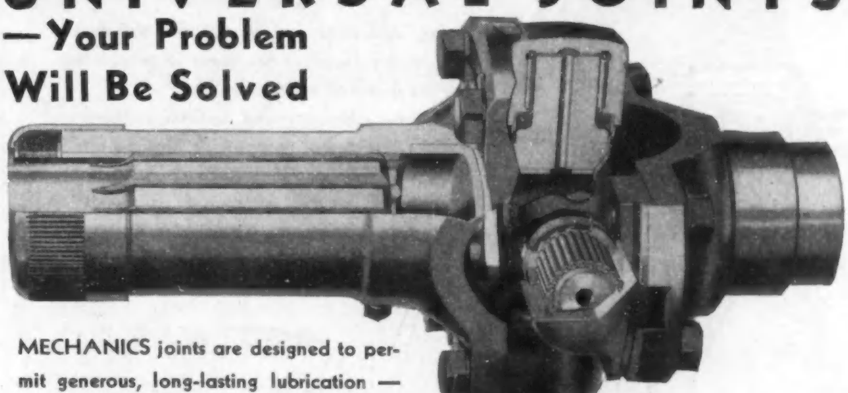
In addition to using high disc ratios to obtain high pressures, both exit and entrance vanes are used before and after the fan and result in considerable performance improvement. In certain cases very marked performance variation has been obtained by using adjustable vanes in the entrance housing of a fan; and by rotating these vanes on their axis, it is possible to obtain wide variation in airflow with consequent variation in horsepower.

Great strides have also been made in reduction of noise due to careful design of blade shapes and profiles. The increase in the pressure coefficients of the fans means that equivalent pressure to those formerly obtained can be developed with lower rotating speeds and smaller size.

It is not difficult to see that the axial-flow fan, because of its compactness, is well suited to installation on aircooled engines and that sufficient pressures can be obtained to make it practical. Also this cooling can be done in the engine temperature range selected by the engine manufacturer.

Careful study of the air passages to the fan and from the engine makes possible savings in fan power and reduction in fan pressure required to give adequate cooling. The area directly in front of the fan is doubly important since it governs the distribution of air itself into the fan and thereby has an effect on the actual ability of the fan to develop the required pressure. Proper selection of the type, size, and characteristics of the fan to be used should be carefully studied since improper selection might result in considerable waste of power.

An important factor in obtaining maxi-



mum performance with an axial-flow fan is maintenance of the minimum tip clearance permissible in the given installation. The effect of tip clearance becomes more pronounced as the pressures increase and as the fan stall point is approached.

Another important point in proper selection of fans for aircooled engines is the actual construction of the fan itself, since it is usually subjected to abnormal stresses, especially when mounted directly on the engine and not driven by belts. In this case, there are likely to be excessive forces due to torque impulses and engine vibration. In some designs subjected to extreme vibration, we have provided in the disc section a large rubber mounting so fashioned that the fan could not move out of a plane perpendicular to its axis of rotation, but could absorb vibration by slight freedom around its axis. The fan center was held coincident to the rotating axis to prevent setting up out-of-balance vibration.

Of major importance in the design of an aircooled installation is the proper balancing of the fan, baffling system, and duct system in order to obtain the optimum results from the minimum amount of air, permitting smaller diameter in a fan, lower speed, less noise, less cost, and lower power requirements.

Airframe Construction Processes Incorporate Flexibility and Speed

by T. N. KELLY

Consolidated Vultee Aircraft Corp.

■ *1944 National Aeronautic Meeting*

(Excerpts from a paper entitled "Analysis of Airframe Production Methods in the Aircraft and Automobile Industries")

IN airframe manufacture, the manufacturing problem consists of the production of precision sheet metal structures, of complex design, at a moderate rate of production. There is no similar production problem involved in the manufacture of automobiles. The degree of precision required in the construction of an automobile body is entirely different from that required for an airframe component.

Plant Facilities–The first consideration in the manufacture of a product is the plant facility available. After even the most preliminary survey of the airframe construction problem, it was obvious that complete aircraft could not be built in the average automobile plant. These plants are ordinarily multifloored, with low ceilings and small open bays between the structural columns. Heavy presses and shears, as well as heat-treating and processing equipment, must ordinarily be located on ground-floor levels. The use of upper floors, then, must be devoted primarily to subassembly operations. This introduces a serious handling problem in the transmitting of tens of thousands of small pieces from the fabricating departments on the lower levels to the upper subassembly stations.

Prewar aircraft plants, although smaller in floor area, were mainly single-floor buildings, with high ceilings and large structural bays. Single-floor construction has made possible great flexibility in plant layout, as heavy fixtures, presses, and processing equipment could be placed to provide the most efficient flow of material. The advantages of plant layout, therefore, are definitely in favor of the aircraft manufacturer and have promoted, to a large extent, the efficiency and production of these companies.

Fabricating Equipment–The first fabricating operation in sheet metal work is the creating of the blank or pieces of metal from which the formed stamping is to be made. The automobile factories used medium to high-speed mechanical presses with blank and pierce dies designed for the production of a million or more pieces during a production year. Because of the high production rate required, most of these presses were equipped with material feeding devices, and elaborate gaging mechanisms which were useless for moderate aircraft production rates.

The aircraft companies had been using, to a large extent, a device borrowed from the woodworking industry called a router. The blanking operation using this method consisted of milling a stack of sheet metal to the contours determined by a template, which formed the upper plate of the stack.

This method, although far from ideal, gave adequate production at a consistent cost.

The automobile industries adopted the router almost immediately for all but the least complex blanking operations. The unused mechanical press equipment, however, stimulated the development of inexpensive blanking dies. Even before the actual entry of this country into the war, aircraft tool engineers were using experimentally, inexpensive blanking dies made of air-hardened steel sheets and also of kirksite, a nonferrous alloy of the type-metal variety. The automobile industry picked up these developments to utilize their additional press equipment. With the increase in rates of production, aircraft companies also expanded their utilization of mechanical presses so that at the present time both industries are using practically identical methods.

Assembly Equipment—The attachment of sheet metal structures by riveting is a process that has been attacked vigorously by both automobile and aircraft production engineers. The aircraft production engineers have led the field in the development of automatic riveting machines and the adaption of gang and individual squeeze riveting presses for the replacement of the hand vibrator and bucking bar.

When the aircraft industry began to show confidence in the spot welding of aluminum alloy, the automobile industry, with their long experience in the production efficiencies gained by the spot welding of steel, were able to contribute very effectively. Their knowledge of production requirements led to the construction of heavier spot-welding equipment, made necessary by the increased production rates and their experimental work on the effects of pressure-heat cycles and the use of refrigeration to prolong the life of the electrodes, as well as their many contributions in the handling of spot-welded assemblies, have been of the greatest utility to both industries. We do not believe it an overstatement to say that the automobile companies are doing the best job of spot welding of aircraft structures at the present time.

Management Controls—The designing and initiating of production of aircraft has always been characterized by haste to produce the initial unit or prototype airplane. This urgency has, no doubt, been largely influenced by the rapid development in airplane design. Many of the normal steps that characterize the introduction of a new design or product into the fabricating departments of a company often have been omitted in the preparation for production of the first airplane. Those steps that are most often omitted, or at least are gravely slighted, are the estimating of costs, the planning of processes and routing, time and motion study, production follow-up, and cost analysis. The refusal of automobile companies to eliminate these processes prior to the production of their initial units has been one of the most consistent causes for misunderstanding and friction. Invariably, the automobile companies have been slow on their initial deliveries of airframe components. Almost without exception, their production acceleration, on the other hand, has surpassed the aircraft contractor.

Because of the complexity of material control under governmental regulation, the control policies of aircraft companies, from the raw stock to the finished product, are excellent. Every part in the completed airplane can be checked back, in a very short time, to determine the heat-treating conditions,

processing conditions, chemical and physical analysis of material, source of supply, date of receipt, purchase order, and even the heat number of the original mill. No similar problem existed in the automobile industry, and considerable difficulty was experienced when airframe construction began in these plants. However, these troubles have been largely eliminated by adopting the methods of the aircraft companies.

Engineering Standards - Few of the airplanes in production today were designed to be produced either in the quantities now required or under the conditions of dispersion now prevalent. The original drawings were made for the production of a limited number of airplanes in plants provided with skilled personnel, capable of producing almost anything which the engineer could conceive. Haste in producing the original design, as well as the uncertainty of production, led to many engineering errors. Floods of changes have also adversely affected the accuracy of the drawings. The automobile manufacturers, however, have insisted on a high degree of engineering accuracy in their own engineering drawings, because of the very high tooling costs involved. The lesson that absolute accuracy in engineering draftsmanship is essential to production has been learned by the aircraft industry at a tremendous cost.

It is hoped that the government agencies involved will recognize their responsibility by permitting and, in fact, insisting that proposal drawings be completely revised and all drawings thoroughly checked for dimensional accuracy and production adaptability, as well as structural suitability and weight.

Conclusions – The automobile industry's major contributions to the aircraft industry are the natural result of its maturity. Most important of these are its demonstrations of organization and management controls; its insistence on engineering accuracy; and its cost consciousness. The aircraft industry's contribution to the automobile manufacturer is the result of its youth. Of these, the stimulation of interest in new materials and methods will have the most lasting effect.

DISCUSSION

It doesn't matter much whether the aircraft or the automobile industry has changed more during the period of the production of airplanes by the automobile manufacturers. What is more important, John C. Squiers, Briggs Mfg. Co., emphasized, is that both industries have shown a high degree of adaptability in altering their production methods to suit war conditions.

In this process, the automobile industry has had to change many of its ideas in going from a relatively simple mass-produced auto to a low-production complicated airframe. There is one characteristic, however, that still seems to be much more evident in the automobile industry, that is, its production mindedness.

"This way of thinking," Mr. Squiers concluded, "has been ingrained into all of the key personnel for years while producing auto parts in huge quantities. The fundamental importance of keeping the production line moving is not merely recognized as a fact but seems to be inherent in the consciousness of the men to such an extent that all decisions, including engineering ones, are strongly influenced by it."

R. Young, Glenn L. Martin Co., took issue with Mr. Kelly's statement that the automotive industry had been largely responsible for the development and construction of heavier aluminum spot-welding equipment. In 1939, Mr. Young said that the Sciaky machine, then made in France, was tried out by aircraft manufacturers in America. As a result of fining the equipment not heavy enough, they insisted that it be redesigned, which brought into being the first magnetic-stored machine adaptable to high-speed production. This then led to the development of the successful capacity stored-energy machine. These two types form approximately 90% of the aircraft spot-welded output today.

The aircraft industry has had some of the cost consciousness of the automobile industry, Mr. Young also said; however, the tremendous growth of the industry in a short time had made it difficult, if not impossible, to develop management controls to the point of refinement found in the automobile industry. The demands of the customer for limited quantities, rigid specifications of quality, adherence to schedules and design changes, as well as the industry's problems of design improvement, organization growth, and revision of small-shop systems to those of large production have all contributed to the problem of developing management controls.

Versatile "Mosquito," Built of Wood, Serves As Fighter and Bomber

by R. B. McINTYRE
de Havilland Aircraft of Canada, Ltd.

■ ***1944 Annual Meeting***

(Excerpts from a paper entitled "Design Features of the Mosquito Airplane")

THE Mosquito is a successful high-speed combat airplane. Contrary to the once popular theory that a military machine can perform only one task efficiently, the Mosquito is used with success in many versions – as a day and night bomber, a long-range day and night fighter, as a fighter-bomber, and for photographic reconnaissance.

It is the fastest aircraft in operation in the world. It has full fighter strength factors, fighter maneuverability, light handling, and straightforward flying qualities. All this is obtained with an airplane in which the whole basic load-carrying structure is fabricated in wood.

The Mosquito is a midwing, twin-engine monoplane having a span of 54 ft and an overall length of 41 ft. The mainplane is continuous through the fuselage and is based on two spars running from tip to tip. This wing is characterized by a pronounced taper, and is aerodynamically swept forward, having a taper ratio of 3.2:1. The plane is powered with two Rolls-Royce Merlin engines. This engine is 12-cyl, V-type, liquid-cooled; the American equivalent being the Packard V1650.

The coolant radiators are housed in the leading edge section of the inboard wing, the cooling air being drawn from the leading edge and ejected through a controlled exit in the wing undersurface. This gives an exceptionally clean cooling arrangement, having almost zero cooling drag at speed.

The undercarriage retracts aft and up into the engine nacelles, and the tail-wheel also retracts, resulting in a clean surface with a minimum of parasite drag.

The engine nacelles are unusually long, this being done to secure a greater directional stability than would otherwise be obtained with the use of a single fin and rudder.

The wing, fuselage, tail plane, fin, and flaps are fabricated entirely of wood. The skins are fully stressed throughout. Wood was chosen for several reasons. Wood made it possible to get through design and prototype stages and into production quickly. The low density of wood gives a structure that has a better elastic stability than metal. Wood gives a structure capable of easy and quick repair. It enables a fresh labor group to be employed. Its use taps new material supplies.

The fuselage is monocoque with seven transverse bulkheads. The shell is stopped off at the aftermost bulkhead and the empennage loads are fed into the fuselage through metal struts fixed to fittings on these bulkheads. This arrangement gives easy adjustment and access for repair, as well as a clear-cut stress system.

As is usual in fuselages of this type where the available depth is great, the skin stresses are comparatively low, so that the problem

is fundamentally one of securing a buckle-resistant structure. The additional problem is that of carrying stress around the inevitable holes, cutouts, door frames, and the like. It is here that the advantages of wood show up particularly well, since due to its low density, greater thickness of material must be used to carry the loads than would be the case in a corresponding metal ship. In the case of the Mosquito, the thickness of the fuselage shell was made even greater by dividing the required plywood thickness in two and separating these skins by a core of balsa wood. The balsa is not a load-carrying material but simply a continuous supporting medium for the stress-carrying skins. It must, however, be shear connected to these skins; hence, the only requirements for this core material are that it shall glue easily to the birch plywood, be light in weight, and not absorb excessive quantities of moisture during the gluing operations.

Where it is necessary to strengthen the shell locally for concentrated loads, or to stiffen the edges of cutouts, it is readily done by replacing the balsa core at any section by spruce or molded birch inserts between the ply skins. The total thickness of the fuselage shell is about ½ in., and this is constant throughout.

The monocoque is made in two halves; the division being the plane of symmetry. This permits accessibility during the initial phases of fuselage construction, since a good deal of the equipment may be fitted before the halves are joined. The joining is accomplished by plywood lap strips at the top and bottom of the shells. These are glued in place after the two halves are correctly aligned longitudinally.

Since the wing is continuous, only four fuselage attachment points are required. Two of these are fixed fittings, bolted directly to bulkhead No. 3 and braced longitudinally by spruce members glued to the inside of the shell. These pick up the lower side of the wing rear spar. The remaining two fittings are adjustable and feed the wing loads directly into the shell through a large spruce member glued into the shell above the wing opening. These pick up the top side of the wing close to the front spar. The adjustable nature of these fittings is a distinct advantage, both in production and field maintenance.

Concentrated loads such as those arising from the engine, undercarriage, radiators, and fuselage are conducted into the primary wing structure by metal fittings bolted through the ribs or spars. Where the bolt bearing stresses in the timber may be excessive, special fabric-base bakelite blocks are glued to the timber under the fittings. To enable these blocks to be glued, they are made up with birch facings, which provide the gluing surface.

Everywhere throughout the structure, woodscrews are used where members are glued together. These screws are driven while the glue between the joints is still wet. In this way adequate glue line pressure is secured and the presence of these screws guarantees against subjecting the glue lines to any tensile load. In no case is the screw area figured in shear, but no hole deductions are made from the glue line area. Permissible glue line shear stresses, of course, depend upon the timbers being jointed and the relative grain directions of the two pieces. Between birch ply and spruce, 380 psi is used, while only 300 is permitted between ash and birch. In some cases, allowable shear values of 450 psi are used. On all external surfaces care must be taken to see that the screws are driven to just below the ply surface.

One of the most important design considerations in connection with wooden aircraft is adequate protection against the ingress of moisture. During the detail design stages, care must be taken to see that ample ventilation and drainage are provided from all closed compartments. In the case of closed ribs, bulkheads, spars, and the like, holes approximately ⅛ in. in diameter should be drilled through the low point of every compartment, and, if possible, internal communication between successive compartments should be provided. For closed volumes in the wing, tail, or fuselage, drain holes up to ½ in. in diameter should be called for and the edges of these holes protected by the use of an ordinary grommet. Places where the end grain is exposed are particularly dangerous and are best protected by several coats of sealer. For all external surfaces it has been found best to encase the entire component in fabric laid in dope. This fabric is then filled and sanded smooth. The sanding operation is extremely important since it removes all the upstanding fibers, which tend to act as wicks to the moisture. After sanding, the usual protective and camouflage coats are applied.

PROPOSE WORLD AGREEMENT FOR FREEDOM OF AVIATION

by H. R. THOMPSON
American Airlines, Inc.

▪ Cleveland, May 8

(Excerpts from paper entitled "Aviation Looks at the New World")

SEVENTEEN domestic airlines of the United States have agreed on a program which we feel best serves the interests of our country.

Essentially we oppose any monopoly either in private hands or Government-owned international air transportation after the war. Those domestic airlines which may care to do so should be permitted to fly to the far places of the world, subject only to a proper finding of public convenience and necessity by the Civil Aeronautics Board.

The United States should immediately initiate negotiations on a multilateral basis with all friendly powers to obtain worldwide freedom of transit in peaceful flight – the privilege permitting commercial aircraft to fly above any foreign country and to land on foreign territory for refueling, repairs or other operational requirements. Worldwide commercial outlets should also be provided – the privilege granted by one nation to the aircraft of other nations to operate to and from a point or points within its territory, picking up and discharging international passengers, mail and cargo, subject to rules and regulations.

The United States should not grant cabotage to foreign carriers – the carriage of traffic originating in and destined to a point within the same country – to foreign flag airlines, and our foreign air carriers should only exercise cabotage rights in foreign countries when such countries permit or request it.

Many domestic airlines in the United States have proved their ability to provide international air service in the interests of peaceful commerce, national security and national policy. Judging by the services performed by foreign air carriers before the war, and with the knowledge that during the war we developed superior aircraft for air transport purposes as compared with the aircraft of other nations, coupled with the fact that we now know more about ocean flying than the nationals of any other country, we have no fear from a competitive angle. International air transportation will so facilitate the intermingling of peoples and the commercial interchange with all foreign nations that it can easily occupy a major role in expressing our international attitude.

There has been much discussion of the type of aircraft to be used after the war. For about two years we will use converted aircraft now in war service. After this time there will be new aircraft specifically designed for air transportation. There will be several sizes and types of aircraft in use to meet particular requirements – from the small, normally short-range, low-altitude, relatively low speed, maximum utility airplane for feeder line development, to a medium-range plane for longer distances, and then the largest, long-range, high-altitude, pressurized, high-speed, deluxe, transoceanic and transcontinental airlines. In addition, there will be low-cost cargo ships for the great quantities of cargo which will have to be moved both domestically and internationally.

Rates for passenger travel and cargo haul are expected to be reduced. With greater aircraft and operating efficiency per ton mile, cost of operation will decrease, and rate reduction will follow.

It is safe to predict that every community of any consequence in this country will have air transportation. We hope for an orderly development of domestic aviation which will avoid the many difficulties faced by railroads and bus companies. There is undoubtedly a place for the so-called feeder line – or regional air service – but the first requirement is a nationwide comprehensive study which will in turn develop a sound pattern for air transportation generally. Presently established air transportation lines are gradually expanding their routes and many communities which deserve through service might be blanked out by too early decision on local type service.

While much attention has been given during the war to airport development, there still remains a major job to be done in this field. Many airports constructed during the war period in the United States will serve cities after the war, but many of them have been located away from cities where their purpose, from our point of view, will be secondary.

Air transport's great potential traffic lies in a developing society. It is an industry which by its very nature requires changed concepts, together with changed procedures and habits in trade and commerce. Its greatest value to civilization is its stimulus to new development and new methods.

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between May 10, 1944, and June 10, 1944.
The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Buffalo Section: John A. Piedmont (A).

Canadian Section: Carl B. Cooper (A), O. D. Cowan (M), Charles Nevin Fouse (A), Albert Granik (M), Charles Ira Lathrem (M), Harley Ion Rosser (M), J. H. Douglas Wilson (M).

Chicago Section: Philip Albanese (J), John W. Anderson (M), Paul Bard (A), Willard F. Blakeway (J), Robert F. Gasvoda (J), Hubert Hollmann (M), Albert H. Kelso (M), Joseph Kim (M), Russell David Libert (J), John E. Menaugh (A).

Cleveland Section: Fred T. Buzard (A), Clarence W. Custer (M), Lee C. Daniels (M), H. W. Delzell (M), A. F. Ilacqua (M), Thomas E. Millard (J), J. Lawrence Myers (M), Harold H. Paterson (A), Stephen G. Scott (A), Warren A. Silliman (M), William T. Stephens (M).

Colorado Group: Victor H. Freesburg (A).

Detroit Section: Robert L. Adams (M), Edward Sylvester Barnum (J), William J. Bird (A), Alfred Lindley Boegehold (M), Louis Drobeck (M), Turner A. Duncan (M), Ronald F. Dusenbery (A), William O. Eastman (M), Delbert C. Flemming (J), Charles Hicks (J), George A. Hirshman (M), John Allan Holt (A), V. C. Hoover (A), Robert C. Hupp (A), Charles Wm. Irwin, Jr. (A) Marshall H. Johnson (A), Carl F. Joseph (M), Thomas Timothy May (J), L. H. Nagler (M), Joseph J. Osplack (M), Ludwig F. Schiele (M), Chester Winston Walters (J), Hubert C. Smith (M).

Indiana Section: C. Lynn Akers (M), Willard T. Nickel (M).

Metropolitan Section: William G. Ball, Jr. (M), Ou-Wen W. Chen (J), Arthur H. Deacon (J), Heyer Products Co., Inc. (Aff.), Reps: A. S. Beams, Earl S. Gray, Robert L. Gray, John W. Horton, John H. St. John, Alton C. Warner, O. Stewart Michael (M), Melvin D. Miller (A), Edgar S. Peierls (A), Charles A. Pribeck (J), Rowell A. Schleicher (M), Gilbert Shaw (M), Joseph Thomas Sullivan (A), William Martin Z'Meeker (J).

Milwaukee Section: George K. Dreher (M), Sherman C. Heth (M), W. H. Naegely (M), George W. Zabel (M).

Muskegon Group: Walter W. Bratton (A), Henry G. Kaye (A).

New England Section: Clarence Crocker Eldridge (A).

Northern California Section: Theodore Heil (A.).

Northwest Section: L. E. Gruennert (A), Howard Lovejoy (J), J. H. Robblee (A), Raymond Dudley Sollars (A).

Oregon Section: Claude A. Bennett (A), Theodore Emerson Bokemeier (A).

Peoria Group: Elmer Isgren (M).

Philadelphia Section: Kenneth W. Anderson (J), Richard A. Booker, Jr. (J), George D. Conlee (A), Thomas D. Joeck (M), Gerald E. Mintz (M).

Pittsburgh Section: Robert L. Kirkpatrick (M), Howard M. Smith (M).

St. Louis Section: Leonard Sidney Echols, Jr. (J).

Southern California Section: James M. Barr (J), Robert H. Bell (J), Davenport Mfg. Co. (Aff.), Reps: Arthur F. Simpson, Jr., Everett T. Small. Douglas E. Donald (A), Donald P. Frankel (J), Clarence L. Gillham (A), Ellis D. McClelland (M), Donald Earl McIntyre (A), Donald D. Paxton (J).

Southern New England Section: Robert E. Johansson (J), James E. Wheeler (J).

Southern Ohio Section: Alva W. Scott (M), William Earle Stilwell, Jr. (M), Henry F. Weiler (J).

Washington Section: Harold Julian Muddiman (A).

Outside of Section Territory: John T. Menietto (A), Avery C. Parrish (A), Robert Twells (M), H. C. Waterhouse (A), Claude Ellsworth White (A).

Foreign: Eduardo de Mello Alvarenga (J), (Brazil).

APPLICATIONS Received

The applications for membership received between May 10, 1944, and June 10, 1944, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Doyle D. Buttolph, Charles R. Carroll, Walter F. Kneip, Edward E. Minor, Jr.

Buffalo Section: Franz F. Kaiser.

Canadian Section: William H. Banfield, Lt.-Col. William Gordon Dewar, Howard Thomas Humby, Edgar Harold Snider, Harry A. Torgis.

Chicago Section: American Photocopy Equipment Co., Barber-Colman Co., David Wilson Deamer, William A. Hallan, Robert Michael Ladevigh, Willard L. Pollard, Edmund P. Strothman, Guy F. Wetzel.

Cleveland Section: Richard C. Adams, Arthur Charles Echler, Richard C. Henshaw, Douglas J. Johnson, Wade C. Johnson, James A. Miller, Ralph F. Schmiedlin, Robert C. Schutt, Robert D. Spencer, Frederick W. Taylor, Donald Louis Wadsworth, Charles Francis Yarham.

Colorado Group: Kenneth E. Allen, Dwight G. Hubbard, Arthur G. Rippey.

Detroit Section: Charles E. Anderson, Dale H. Burke, Carl A. Carlson, A, Emmett Carpenter, George Robert F. Collins, Donald C. Douglas, Harry Charles Dumville, T. W. Flood, Thomas F. Lavender, Fred R. Lewis, John H. Loerch, Harry W. Lutz, Harold A. Mengert, John C. Monahan, Gordon E. Moore, Thomas H. Oliphant, Vaughan Coulton Reid, Myron M. Schall, James H. Wernig, Harry H. Whittingham.

Indiana Section: Joseph S. Williams, Lester Merton Wright.

Kansas City Section: Harvey W. Morrow.

Metropolitan Section: Cleaveland Fisher Colburn, Burns Darsie, Jr., Glidden S. Doman, Richard T. Dunn, William Herbert Grimley, Joseph Sandford Harris, Robert C. Henn, Ensign Harvey I. Kram, Stanley H. Lowy, Robert R. Maffett, Joseph Marinelli, Edward C. Massett, Roger J. Metzler, Harold Winslow Paine, Robert F. Painter, Harold L. Robinson, William F. Schick, Jr., John M. Schnetzler, Nathan Shapiro, Lee Stokes, George S. Trump, William Ernest Wandt, William Henry Wilson, Jr., John W. Zimmermann, Jr.

Mid-Continent Section: Ellis M. Sims.

Milwaukee Section: Gus Sanftheil, Elmer R. Schroeder, William F. Steffen, Malvin H. Teige, Howard A. Tubbs, Newton H. Willis.

Northern California Section: Webb Miller, John Milton Scarlett.

Northwest Section: Howard D. Auld, Glenn Oliver Patchen, Henry T. Robertson, Edward C. Slatky, Henry G. Williams.

New England Section: Donald E. Martel.

Oregon Section: Victor L. Brandt.

Peoria Group: Melvin A. Schmidt.

Philadelphia Section: John F. Bosler, Bernard J. Burica, George P. Henderson, R. H. Hillman, John K. Killmer, Corp. Joseph W. Parkin 3rd.

Pittsburgh Section: J. H. Dunn, Walter Lewis Keene, Charles Joseph Marshall, R. W. McLaughlin, Harry Werksman.

St. Louis Section: Ellis Victor Ford, John Rudolph Rose.

Southern California Section: William A. D. Ebel, James C. Galloway, Glendon T. Gerlach, Eugene William Martin, Louis Meyer, La Verne E. Morgan, Fred Rudolf Reczuch, George W. Smith, Turco Products, Inc.

Southern New England Section: Henry C. Ashley, Charles A. Baresch, Lt. Millard Jeffery Holbrook, Roland A. Labine, Arnold D. Nichols.

Southern Ohio Section: Raymond J. Hausfeld, John V. Rettig, Lt. Evans L. Slater, H. Roger Williams.

Syracuse Section: Albert A. Frank.

Texas Section: Leo Dubinski, I. B. Lindenthal, William C. Stewart, Harry S. Zane, Jr.

Twin City Group: Thomas Martin Thomas.

Washington Section: Parker M. Bartlett, James H. Carmichael, Robert A. Grosselfinger, Warner Lewis, Boris Lomonosoff.

Western Michigan Section: Richard James Roth.

Wichita Section: Paul E. Allen, Duane E. Stone.

Outside of Section Territory: Olaf Walter Andersen, William Harry Faint, Robert William Marriott, Kenneth Ian Morton, William L. Schreiner, James J. Sloan, Jr., Robert V. Thomas.

Foreign: James M. Whiteley, Jr., N.W.I.

OBITUARIES

L. J. Cronkhite

L. J. Cronkhite, branch manager of Fruehauf Trailer Co. of Calif., and 1944-1945 chairman of the SAE Oregon Section, died May 22 at the age of 46. He had been in the truck distribution field practically all of his working career, first in sales and then in managerial capacities. Mr. Cronkhite had been treasurer of the Oregon Section for the past year.

Albert C. Corr

Albert C. Corr, district manager of Gates Rubber Co., died March 31. He was 46 years old. Since 1918 he had been employed by rubber companies, spending much of that time as product engineer for U. S. Rubber Co., Trucker Rubber Corp., and Gates. Four years ago he was appointed to the position he held before his death.

Louis F. Ehring

Louis F. Ehring, equipment superintendent for United Parcel Service, died April 22 at the age of 49. After many years' experience as foreman of maintenance for Lord & Taylor and Elete Co., Mr. Ehring joined United Parcel in New York in 1929, and later transferred to the Philadelphia branch of the company.

Enoch J. Egginton

Enoch J. Egginton, 49, fuels and lubricants engineer for the U. S. Army Ordnance Department, died May 23 after a lingering illness. He did lubrication work for the Army during the first World War, after which he was connected with Standard Oil Co. of Calif. and Pure Oil Co. Before engaging in Government work, Mr. Egginton was general manager of the Vinson Laboratories. He had attended the University of Minnesota.